2020 CSLabs Extension Project

Software Detailed Design Report

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# 1. Data Design

### 1.1 Overview

CSLabs is a virtual lab learning environment created and operated by the Indiana University Southeast (IUS) Computer Security Group (CSG). It is used by IUS faculty and students to practice computer security and learn other aspects of computer science using virtual machines (VM).

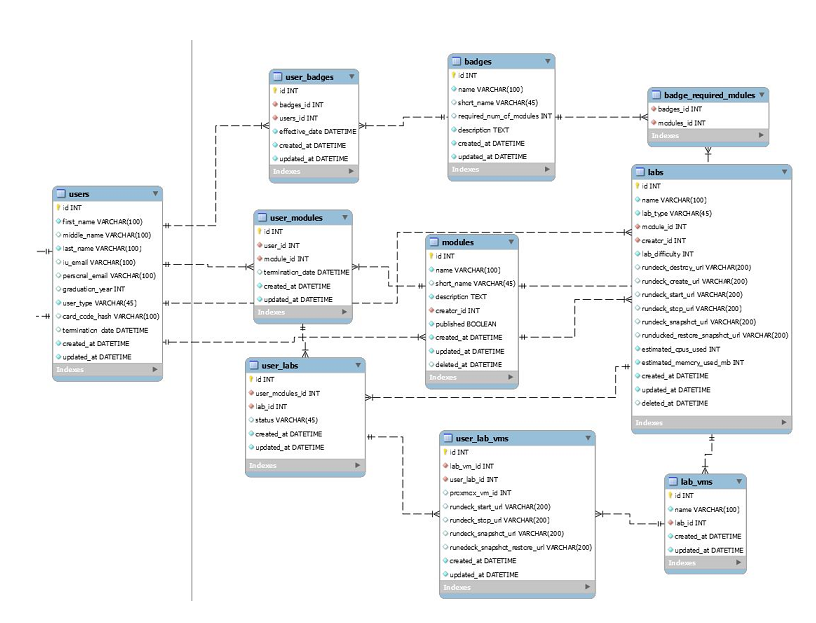
The CSLabs 2020 Capstone project is an extension of the previous year’s Capstone projects. The extension project does not aim to overhaul the existing system architecture. The project objectives are to add new functionalities, system quality enhancements, and user experience improvement to the CSLabs Webapp and backend application.

### 1.2 Data Structure

Gallavin et al.’s team (2019) created the original Entity Relationship diagram below to describe the system data structure. The system creates multiple classes to represent the below referenced tables with the C# HTTP API. Typescript Interfaces in the React frontend are also created to match those tables. A List property exists on the C# class wherever there is a data design relationship.

According to Gallavin et al (2019), CSLabs uses modules as the main system entities. A module contains a list of labs that can be completed much like chapters in a book. Each lab contains a list of virtual machine (VM) definitions that should be used when the lab is started. Badges are awarded when certain modules and other requirements are met. A badge has an attribute called required\_num\_of\_modules that is set if the correct badge is awarded when a certain amount of modules are completed. The badge entity also has a relation to badge\_required\_modules that allows a badge to be awarded when a user completes a certain module(s).

The other concept used in CSLabs is the user entity. The user entity has many attributes shown in the diagram that are mostly used by the infrastructure team. Users relate to user\_badges which are awarded badges that a user owns. The user also has user\_modules, user\_labs, user\_lab\_vms, which are instantiations of the module. These instantiation tracks progression, and lab environment state. For data structures, dictionaries are used on the frontend application to quickly look up entities by Id. The backend uses Lists to store relations since all of the hard work is handled by the database.



**3. Interface Design**

**4. Procedural design**

**5. Key Personnel and Contribution Breakdown**

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| --- | --- | --- |
| Position | Name | Contribution |
| Project leader | Lu, Yiliang | Conduct primary and secondary research; draft and edit reports; coordinate events and meetings; establish a liaison with external parties and advisors. |
| Full Stack Developer | Bello, Junet | Create and manage backlogs; project feasibility consulting; primary developer for the CSLabs backend; alternate project POC |
| Full Stack Developer | Martin, Cooper | Primary developer for the CSLabs web-app frontend; alternate event coordinator; unit testing |

Works Cited

Clifton, Zac et al. "CS labs Infrastructure Details."  29 Oct. 2019, <https://github.com/ius-csg/CSLabs-Capstone-Documentation/tree/master/cslabs-Infra-2019-2020/REPORTS>.  27 Nov. 2020

Gallavin, Jason et al. " CS Labs – Web Software Detailed Design." 27 Oct. 2019, <https://github.com/ius-csg/CSLabs-Capstone-Documentation/tree/master/cslabs-web-2019-2020/DesignDocs>.  27 Nov. 2020