Introduction

DisCUTS, a web application which falls into the type 1 category as described in the project descrption, is an educational discussion forum designed to facilitate communication between students and teaching staff, enables students to post questions, receive answers, and engage in academic discussions.

The motivation behind this project stems from the need for a streamlined, interactive platform where students can conveniently ask questions and receive timely feedback. Traditional methods of communication, such as email or in-person office hours, often prove inefficient and inaccessible for many students. DisCUTS aims to address this gap by offering a centralized, always-available space for academic interaction.

The core objective of DisCUTS is to offer an educational platform that simplifies question-and-answer exchanges. Key features include but not limited to:

- **User Management**: Users can register and log in with security features like password hashing, password recovery via security questions, and persistent login via cookies.
- **Discussion Management**: Users can post questions, sort them under courses, filter posts, and leave comments.
- **File Upload & Image Processing**: The forum supports multiple file uploads, including image processing for resizing uploaded images.

Originally, third party API was used in previous version of this web application, and since the IP is dynamic, such feature had been removed but the security can still be guaranteed by password hashing in the database.

Traditional computing methods, such as locally hosted forums or static websites, struggle with scalability and reliability under high traffic or dynamic interactions. These solutions require manual scaling, lack fault tolerance, and rely on limited local resources, making them inefficient for handling large user volumes. Additionally, managing infrastructure manually increases maintenance and security burdens, leading to higher operational costs and potential downtime during peak periods.

Cloud computing overcomes these limitations with elastic scalability, high availability, and automated resource management. Deploying DisCUTS in the cloud allows automatic scaling based on user demand, ensuring smooth performance during spikes in traffic. Cloud services also provide secure data storage with built-in redundancy and automated backups, ensuring data safety and accessibility. With load

balancing and reduced server management overhead, cloud computing enhances DisCUTS' performance, reliability, and cost-effectiveness.

Technical Solutions

Docker and Kubernetes are being used for deployment, starting for simple deployment with simply Docker to a more complex deployment which supports scalability, rolling updates, rollback features and other benefits brought my using Cloud technology. MySQL is being used for back-end storage and PHPMyAdmin provides an interface to interact with the database. Three micro-services are used in this project, which are MySQL, PHPMyAdmin and a PHP image with Apache.

Previously, DisCUTS was designed under a MVC (Model, View, Controller) framework, with pre-installed modules. To deploy the web application using cloud technology, it was migrated from using MVC framework to micro-service framework, which treats all the packages or modules in the web application as micro-services.

Monthly Cost Estimation

The monthly cost is significantly varied by that choices from the machine type, number of boot disks and local SSD disks and disks size. For deploying DisCUTS the web application, the table below shows the choices and the estimated monthly cost if Kubernetes is being selected (Google, n.d.).

Item	Estimated Monthly Cost
Selected region	
AUSTRALIA-SOUTHEAST2	
Cluster management fee	
$0.10/hour x 730 hours	$73.00
default-pool (n1-standard-2)	
2 vCPU + 7.5 GB memory ($98.40 x 3 nodes)	$295.20
20 GB balanced persistent disk ($2.70 x 3 nodes)	$8.10
Node pool discounts	
Sustained use discount 730 hours x 20% off x 3 nodes	-$88.56
Estimated monthly cost	**$287.74**