SMU Classification: Restricted

SMU
School of
Computing and
Information Systems

Course Code:	**CS464**
Course Name:	**Full Stack Development**
When was the course design document last verified by the Course Manager:	**24 July 2024**

NOTE: The information given in this document is for reference only; the updates given during the class sessions and/or eLearn will supersede the information given in this document.

IMPORTANT NOTICE

SMU Classification: Restricted

1. Synopsis

This course exposes students to full stack development. It is designed to equip students with the skills and knowledge to build robust full stack applications using modern technologies. From backend development in Golang, to frontend user interactions with HTMX, and managing data using both SQL and NoSQL, as well as object storage, to deploying applications on the cloud using containers. Students will gain hands-on development that spans the full spectrum of web development.

2. Prerequisites/Co-requisites

Prerequisite(s): CS203 Collaborative Software Development or IS213 Enterprise Solution Development

3. Course Areas

Business Options
IS: DCS Track
IS: PD Track
IS Depth Electives
IT Solution Development Elective

(Please check Course Catalogue in BOSS for updated information!)

4. Course Objectives

Upon completion of the course, students will be able to:

- ❖ Master Golang for backend development
- ❖ Explore data management
- ❖ Implement APIs with REST and gRPC
- ❖ Understand frontend rendering techniques
- ❖ Leverage containerization and cloud deployment
- ❖ Configuration for web using reverse proxy and DNS management

5. Competencies

1. Demonstrate an understanding of backend development:

    a. Design and implement server-side logic and scalable architecture
    b. Create and manage endpoints for handling web requests
    c. Implement effective security measures to protect data and maintain application integrity

2. Demonstrate an understanding of different database technologies

    1. Compare and contrast between NoSQL vs SQL
    2. Integrate cloud storage solutions to enhance application functionality
    3. Design and implement efficient database schemas that support business requirements
    4. Perform data manipulation and retrieval operations effectively

3. Demonstrate an understanding of API design and management

SMU Classification: Restricted

1. Design RESTful and gRPC services that are scalable and maintainable
2. Implement APIs that efficiently handle data and integrate with other services or databases
3. Analyze and apply appropriate communication protocols for inter-service communication

4. Demonstrate an understanding of frontend development

    1. Design and development dynamic web interfaces using client-side scripting
    2. Evaluate the performance implications of client-side vs server-side rendering
    3. Configuration and setup of DNS to optimize application accessibility, security and performance

5. Demonstrate an understanding of containerization and deployment strategies

    1. Utilize container technology to create reproducible and scalable applications
    2. Deploy applications to cloud platforms ensuring high availability and fault tolerance
    3. Monitor and optimize the performance of deployed applications

6. Teaching Staff

Faculty: Lim Yi Sheng

7. Course Assessments

Assessment Categories	**Weightage (%)**
Assignments (3)	30%
Individual Assignment	20%
Class Participation	5%
Capstone	45%
Total	100%

8. Course Assessment Details

Assignments (3)

Written assignments with coding examples centred around backend development, database design, and API and frontend technologies respectively.

Capstone Project

Students will be assigned to teams of 3-4 members. The group project is to create an end to end working application based off ideas submitted by each group.

Individual Paper

To evaluate and work upon on how they could have improved on their project. The final submission must be a working image with source code.

SMU Classification: Restricted

9. Lesson Plan

Week	Topics	Assessment
1	Course Introduction and Setup	
2	Golang Basics (Syntax, functions, error handling)	
3	Golang Advanced (Concurrency, channels, goroutines)	Assignment 1
4	Database Management (SQL, NoSQL)	
5	Database Management (Object Store and Integration)	Assignment 2
6	API Development (REST, Introduction to gRPC)	
7	API Development (gRPC streaming)	Project Proposal
9	Frontend Technologies (Client vs Server side)	Assignment 3
10	Containerization (Docker/Podman, Dockerfiles)	
11	Deployment to Cloud (Auto scaling, load balancing, DNS management)	
12	Thoughts and considerations + consultation	
13	Project presentation	Capstone
14	Study week	Individual paper

10. Resources

Main Reading:

Title: Designing Data-Intensive Applications
Author: Martin Kleppmann
Publisher: O'Reilly
ISBN: 9781491903100

Tooling:

1. Golang (1.23 as of time of writing).
2. htmx
3. Mongo Atlas
4. CockroachDB
5. Grafana and Prometheus
6. Cloudflare
7. AWS / fly.io
8. Docker / podman
3. Editor of choice (mildly impressed and annoyed, if using vim or emacs)

11. University Policies

Academic Integrity

All acts of academic dishonesty (including, but not limited to, plagiarism, cheating, fabrication, facilitation of acts of academic dishonesty by others, unauthorized possession of exam questions, or tampering with the academic work of other students) are serious offences.
All work (whether oral or written) submitted for purposes of assessment must be the student's own work. Penalties for violation of the policy range from zero marks for the component assessment to expulsion, depending on the nature of the offense.

SMU Classification: Restricted

When in doubt, students should consult the instructors of the course. Details on the SMU Code of Academic Integrity may be accessed at https://smu.sharepoint.com/sites/oasis/SitePages/DOS-WKLSWC/UCSC.aspx.

Copyright Notice

Please note that all course materials are meant for personal use only, namely, for the purposes of teaching, studying and research. You are strictly not permitted to make copies of or print additional copies or distribute such copies of the course materials or any parts thereof, for commercial gain or exchange.

For the full copyright notice, please visit: https://smu.sg/Copyright-notice or *OASIS -> CAMPUS LIFE & EXCHANGE -> CONDUCT & DISCIPLINE -> UNIVERSITY COUNCIL OF STUDENT DISCIPLINE*

Accessibility

SMU strives to make learning experiences accessible for all. If you anticipate or experience physical or academic barriers due to disability, please let me know immediately. You are also welcome to contact the university's disability services team if you have questions or concerns about academic provisions: DSS@smu.edu.sg. Please be aware that the accessible tables in our seminar room should remain available for students who require them.

Digital Readiness for Teaching and Learning (DRTL)

As part of emergency preparedness, instructors may conduct lessons online via the Zoom platform during the term, to prepare students for online learning. During an actual emergency, students will be notified to access the Zoom platform for their online lessons. The class schedule will mirror the current face-to-face class timetable unless otherwise stated.