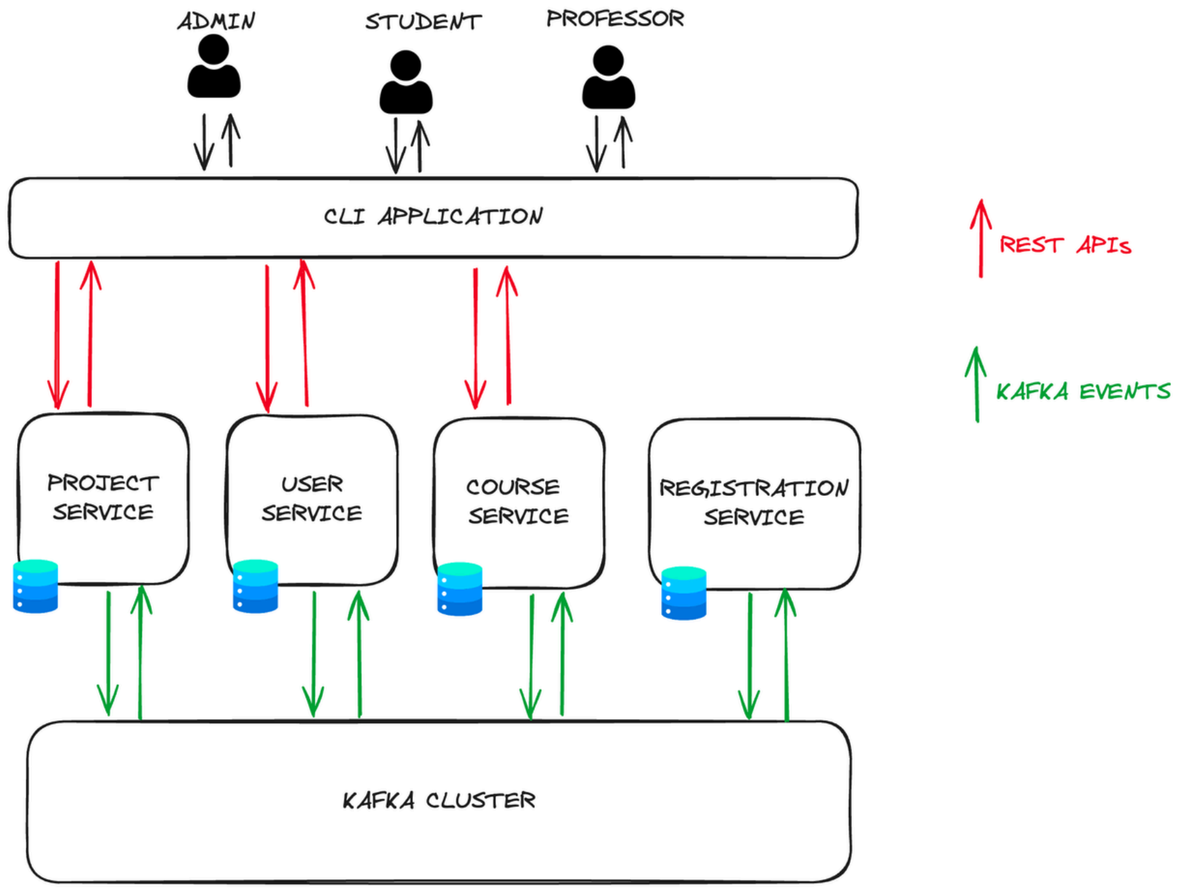
Online Services for Continuous Evaluation

Assumptions and Guidelines

- Services do not share state, only events over Kafka topics
- Services may crash at any time => need fault recovery procedure
- State is implemented using in-memory data structures
- Kafka topics cannot be lost
- No authentication system
- Sum of grades is sufficient when > 50

High Level Architecuture Diagram



CLI Application and Commands

User Role	Commands

Admin	`create-course --id=<id> --name=<name>`
	`get-courses`
	`delete-course --id=<id>`
	`create-student --id=<id>`
	`create-professor --id=<id>`

Student	`get-courses`
	`enroll --course-id=<id>`
	`submit-solution --course-id=<id> --project-id=<id> --submission-id=<id> --solution=<solution>`
	`get-course-projects --course-id=<id>`
	`get-project-submissions --course-id=<id> --project-id=<id>`
	`get-submission-grades --course-id=<id> --project-id=<id> --submission-id=<id>`

Professor	`get-courses`
	`create-project --id=<id> --course-id=<course-id> --name=<project-name>`
	`get-sub --course-id=<id> --project-id=<id>`
	`grade --course-id=<id> --proj-id=<id> --sub-id=<id> --grade-id=<grade-id> --grade=<grade>`

Table 1: CLI Commands for Different User Roles

Microservices Overview

Microservice	Endpoint	Method	Description	End-User
Project Service	/courses/:course-id/projects/create	POST	Creates a new project for the given course	Professor
	/courses/:course-id/projects/:project-id/submit	POST	Submit solution for project of a course	Student
	/courses/:course-id/projects/:project-id/submissions/:submission-id/grade	POST	Grade a solution submission of a student	Professor
	/courses/:course-id/projects	GET	Retrieve projects of a course	Student
	/courses/:course-id/projects/:project-id/submissions	GET	Retrieve solution submission of a project	Professor
	/courses/:course-id/projects/:project-id/submissions/:submission-id/grades	GET	Retrieve grade of a solution submitted by a student	Student
User Service	/users/student/create	POST	Creates a new student	Admin
	/users/professor/create	POST	Creates a new professor	Admin
Course Service	/courses	GET	Retrieves all courses	Admin, Professor, Student
	/courses/create	POST	Creates a new course	Admin
	/courses/:course-id/delete	DELETE	Deletes a specific course	Admin
	/courses/:course-id/enroll	POST	Enrolls student in a specific course	Student
Registration Service	Not applicable	N/A	Does not expose REST endpoints	N/A

Table 2: REST endpoints exposed by microservices

- Each service, except for the Registration, communicates with the end-user by exposing REST endpoints
- Each service keeps in-memory state; no database!

Kafka Cluster Configuration

Topic: Student

Producer(s): User Service
Consumer(s): Course Service

Topic: Professor

Producer(s): User Service
Consumer(s): Project Service

Topic: Course

Producer(s): Course Service
Consumer(s): Project, Reg. Service

Topic: Enrollment

Producer(s): Course Service
Consumer(s): Project Service

Topic: Project

Producer(s): Project Service
Consumer(s): Reg. Service

Topic: Completed

Producer(s): Reg. Service
Consumer(s): User Service

Topic: Submission

Producer(s): Project Service
Consumer(s): Reg. Service

Topic: Grade

Producer(s): Project Service
Consumer(s): Reg. Service

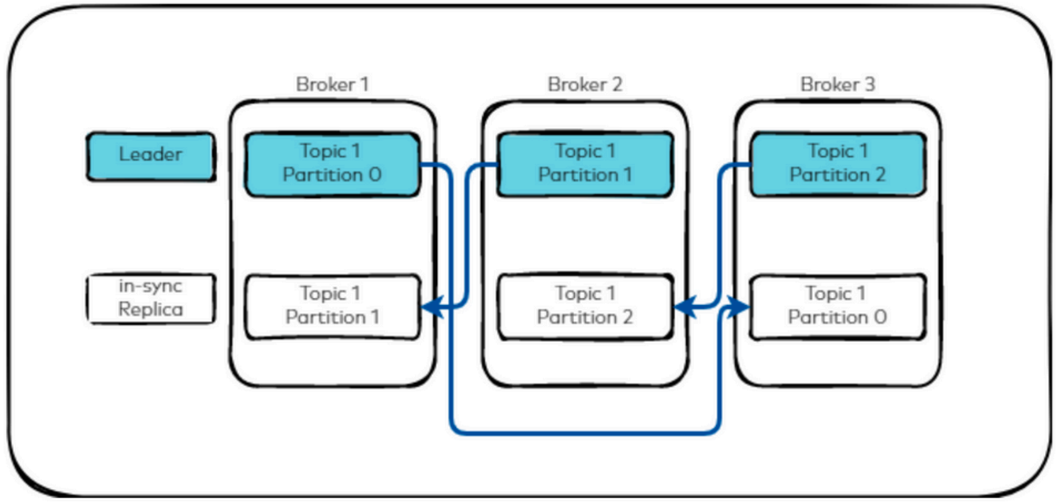
Every microservice that produces on a topic also consumes on the same topic.

Reason: *Recover its state during a crash.*

Design Choices

- Easy to build a server
- Goroutines
- Concurrency capabilities

- 7-day-old message are deleted
- Replication factor of 3



Implementation Details 1 of 2

confluent-kafka-go

- Good integration with Confluent Cloud

+

kafka-wrapper-go

- Shared code between microservices

Producer

- Headers: action type (add, delete, etc...)
- Kafka decides the optimal partition based on the current partition load

Implementation Details 2 of 2

Consumer

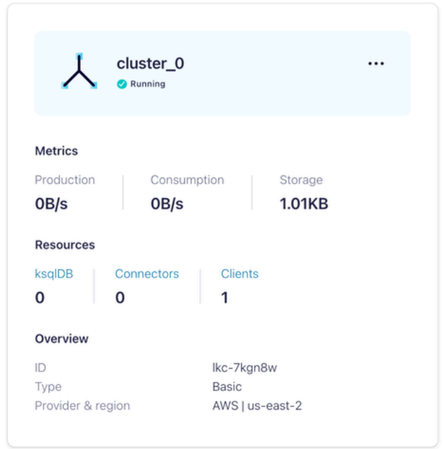
- Consumer group set to “evaluation-sys-<microservice-name>”
- Each microservice has their consumer group => allows different microservices to consume the events on the same topic in parallel
- “auto.offset.reset” configuration set to earliest => read from earliest uncommitted message
- Seek to beginning of each assigned partition => **Fault Recovery**

Deployment

for the microservices

Environment name	Health	Application name	Platform	Domain	Running versions	Tier na...
Eval-sys-course-env-docker	Ok	eval-sys-course	Docker running on 64bit Amazon Linux 2023	Eval-sys-course-env-docker.eba-ij33i5hc.eu-north-1.elasticbeanstalk.com	eval-sys-course-version-2	WebServer
Eval-sys-project-env-docker	Ok	eval-sys-project	Docker running on 64bit Amazon Linux 2023	Eval-sys-project-env-docker.eba-tx9pz6g2.eu-north-1.elasticbeanstalk.com	eval-sys-project-version-2	WebServer
Eval-sys-registration-env-docker	Ok	eval-sys-registration	Docker running on 64bit Amazon Linux 2023	Eval-sys-registration-env-docker.eba-rwrpvejf.eu-north-1.elasticbeanstalk.co...	eval-sys-registration-version-3	WebServer
Eval-sys-user-env-docker	Ok	eval-sys-user	Docker running on 64bit Amazon Linux 2023	Eval-sys-user-env-docker.eba-qj3fh5wc.eu-north-1.elasticbeanstalk.com	eval-sys-user-version-8	WebServer

for the Kafka cluster



Thank you!

Q&A