SERVICE ORIENTED ARCHITECTURES

ACIT3855 – FALL 2021

AGENDA

- Quick Review
- Quiz 4
- Overview of Processing Service
- Lab 5
  - Processing Service

REVIEW

- What would be examples of metadata in an OpenAPI specification?
- What do the paths represent?
- Within a path, what would we use the post and get keywords for? How are these different?
- How do associate the OpenAPI specification with our code?
- Why do we define component schemas in an OpenAPI specification?

QUIZ 4

- Quiz is on the Learning Hub
- Open book, you may refer to the reading materials
- You have <15 minutes to complete it

COURSE SCHEDULE – TUESDAY SET

Week	Topics	Notes
1	• Services Based Architecture Overview • RESTful API Review	Lab 1
2	• Microservices Overview • Edge Service	Lab 2, Quiz 1
3	• Database Per Service • Storage Service (SQLite)	Lab 3, Quiz 2
4	• Logging, Debugging and Configuration • Storage Service (MySQL)	Lab 4, Quiz 3
5	• RESTful API Specification (OpenAPI) • Processing Service	Lab 5, Quiz 4, Assignment 1 Due
6	• Synchronous vs Asynchronous Communication • Message Broker Setup	Lab 6A, Quiz 5
7	• Messaging and Event Sourcing	Lab 6B, No Quiz
8	• Midterm Review • Containerization of Services (Docker/Docker Compose)	Lab 7, Quiz 6, Assignment 2 Due (Midterm Review)
9	• Dashboard UI and CORS	Lab 8, Quiz 7
10	• Issues and Technical Debt	Lab 9, No Quiz
11	• Deployment – Configuration and Logging	Lab 10, Quiz 8
12	• Deployment – Reverse Proxy and Load Balancing • Deployment – Scaling (RESTful APIs)	Lab 11, Quiz 9
13	• Final Exam Review • Assignment 3 In Class	Assignment 3 Due
14	• Final Exam	

COURSE SCHEDULE – THURSDAY SETS

Week	Topics	Notes
1	• Services Based Architecture Overview • RESTful API Review	Lab 1
2	• Microservices Overview • Edge Service	Lab 2, Quiz 1
3	• Database Per Service • Storage Service (SQLite)	Lab 3, Quiz 2
4	**No Class - Holiday**	
5	• Logging, Debugging and Configuration • Storage Service (MySQL)	Lab 4, Quiz 3, Assignment 1 Due
6	• RESTful API Specification (OpenAPI) • Processing Service	Lab 5, Quiz 4
7	• Synchronous vs Asynchronous Communication • Message Broker Setup • Messaging and Event Sourcing	Lab 6, Quiz 5
8	• Midterm Review • Containerization of Services (Docker/Docker Compose)	Lab 7, Quiz 6, Assignment 2 Due (Midterm Review)
9	• Dashboard UI and CORS	Lab 8, Quiz 7
10	• **No Class – Holiday.** Issues and Technical Debt (Take Home)	Lab 9, No Quiz
11	• Deployment – Configuration and Logging	Lab 10, Quiz 8
12	• Deployment – Reverse Proxy and Load Balancing • Deployment – Scaling (RESTful APIs)	Lab 11, Quiz 9
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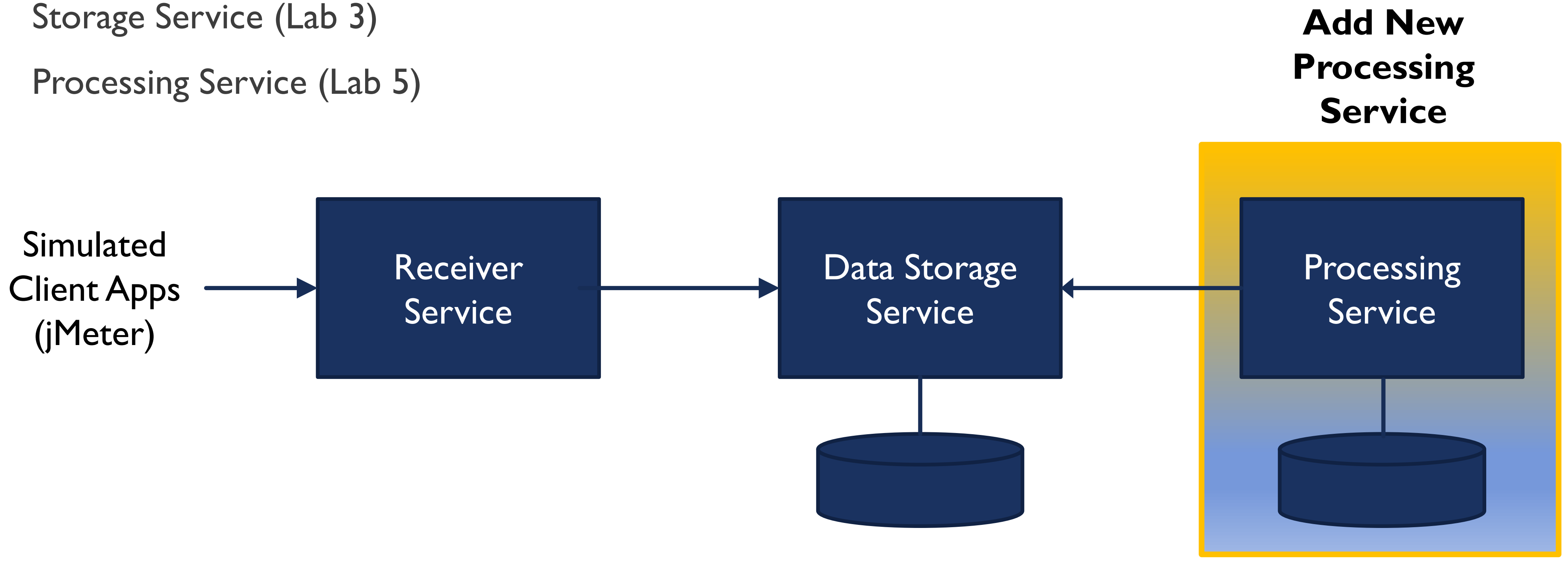
OUR SAMPLE APPLICATION

Our sample application will have three initial services:

- Receiver Service (Lab 2)
- Storage Service (Lab 3)
- Processing Service (Lab 5)



Includes:

- RESTful API
- External Config
- Logging
- JSON Datastore
- Periodic Processing

OPENAPI SPECIFICATION

What are the benefits?

- Allows you to do upfront design that can easily be reviewed by others
- It can be committed to a source code repository for collaboration and audit
- Generate documentation for users of the API
- Generate code (clients and/or server)
- Validate requests and responses against the specification

Generally each Microservice will have its own API specification (independent of other services).

For Edge Services, like our Receiver Service, that API specification (and documentation) may be provided to external clients of that API.

WALKTHROUGH OF AN OPENAPI SPECIFICATION

- Let’s walkthrough the OpenAPI Specification of a sample Data Storage Service
  - Metadata
  - Resources and HTTP Methods (POST and GET)
    - Request Messages and Parameters
    - Response Messages
  - Component Schemas

PROCESSING SERVICE

- Sometimes we need a service that processes data or events (for example: anomaly detection, reporting)
- The service can be designed to do its processing upon receipt of new data or events
- However, sometimes it's more efficient to process the data or events in batches, especially if there are no requirements for "real-time" processing
- Our **Processing Service** will periodically process "batches" of recently received events
  - Its processing will be to calculate statistics on those events (i.e., number received, min/max value received, etc.)
  - It will store those statistics and provide an API to retrieve them

PERIODIC PROCESSING

- Sometimes we want to perform the same task on a scheduled basis (i.e., every few seconds, minutes, days, etc)
- Python has a module, apscheduler, that let's you create background processes
- This will not block your RESTful APIs

```
from apscheduler.schedulers.background import BackgroundScheduler


def background_job():
    """ Periodically do something """
    print(“Doing something”)

def init_scheduler():
    sched = BackgroundScheduler(daemon=True)
    sched.add_job(background_job, 'interval',seconds=30)
    sched.start()
```

This is somewhat similar to a cron job you may be familiar with where you can schedule a task to run on a schedule.

We'll briefly demo apscheduler now

OUR PROCESSING SERVICE

Data Store Updates:

- Add two new GET endpoints, one per event type, that will query for all events with a date_created timestamp greater than or equal to a given timestamp provided as a parameter on the endpoint.

Processing Service:

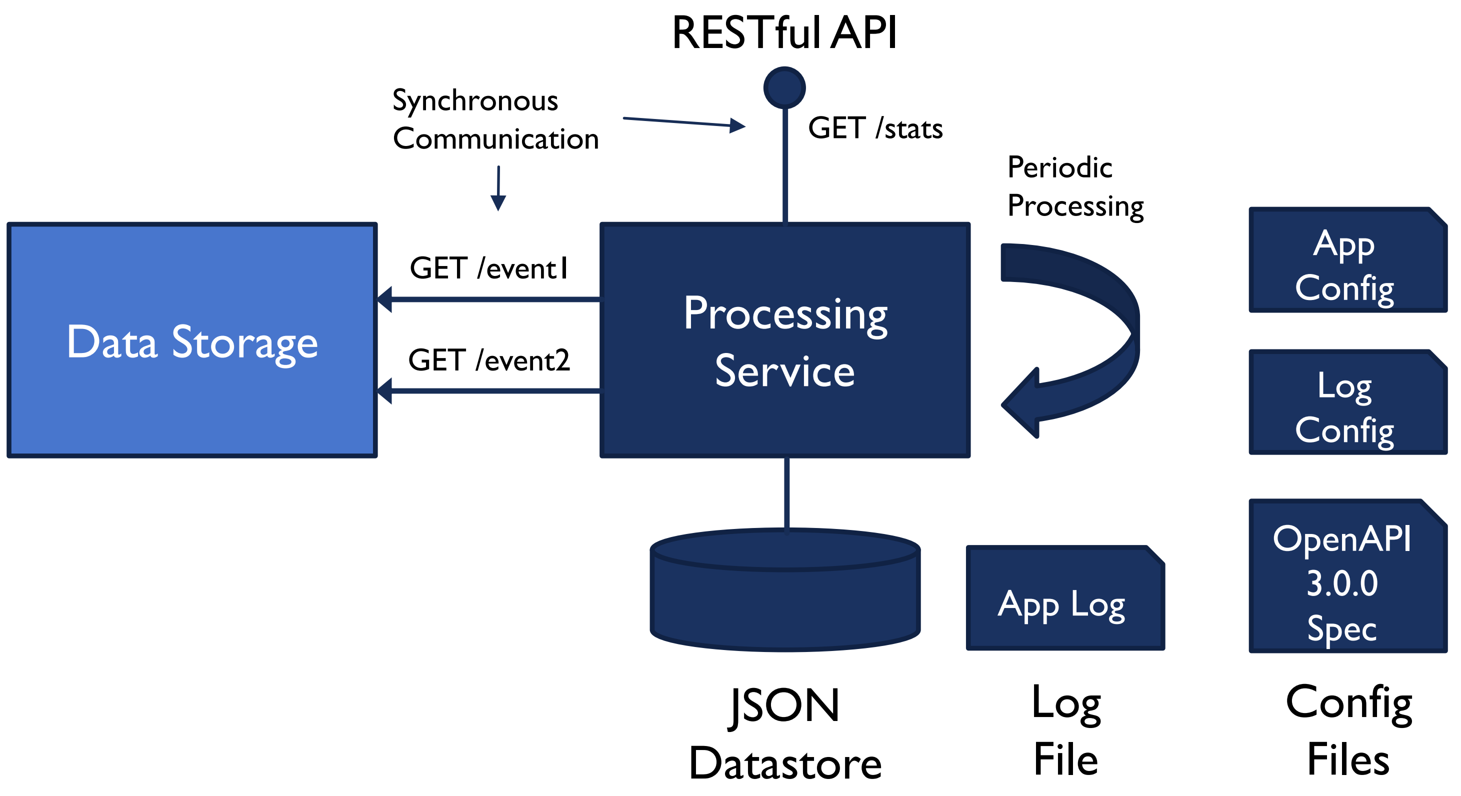
- Includes a RESTful API (with an OpenAPI Spec), logging, external configurations (app and log) and makes API requests to another service (the Data Storage Service). It adds periodic processing as a background scheduled task.
- Periodically polls the Data Store, using the two GET endpoints for retrieving new events in the datastore by passing in a timestamp parameter of the last time it requested those events
- It uses those events to gather some statistics (i.e., number of event1, number of event2, max event1, max event2)
  - The statistics should be cumulative
- It writes those statistics in a JSON file, along with the timestamp of the last time it retrieved new events
- It provides a GET endpoint to retrieve the current values of the statistics

OUR PROCESSING SERVICE

Putting Everything Together in the **Processing Service**:

- Synchonous Communication – Providing and Using RESTful APIs using OpenAPI 3.0.0, connexion and requests
- Separate DataStore (JSON)
- Configuration and Logging

And adds periodic processing (i.e., a scheduled task) to our application.



OUR PROCESSING SERVICE

- Example JSON file for our Processing Service

```
{
    "num_bp_readings": 203,
    "max_bp_dia_reading": 160,
    "max_bp_sys_reading": 100,
    "num_hr_readings": 200,
    "max_hr_reading": 197,
    "last_updated": "2021-02-05T12:39:16"
}
```

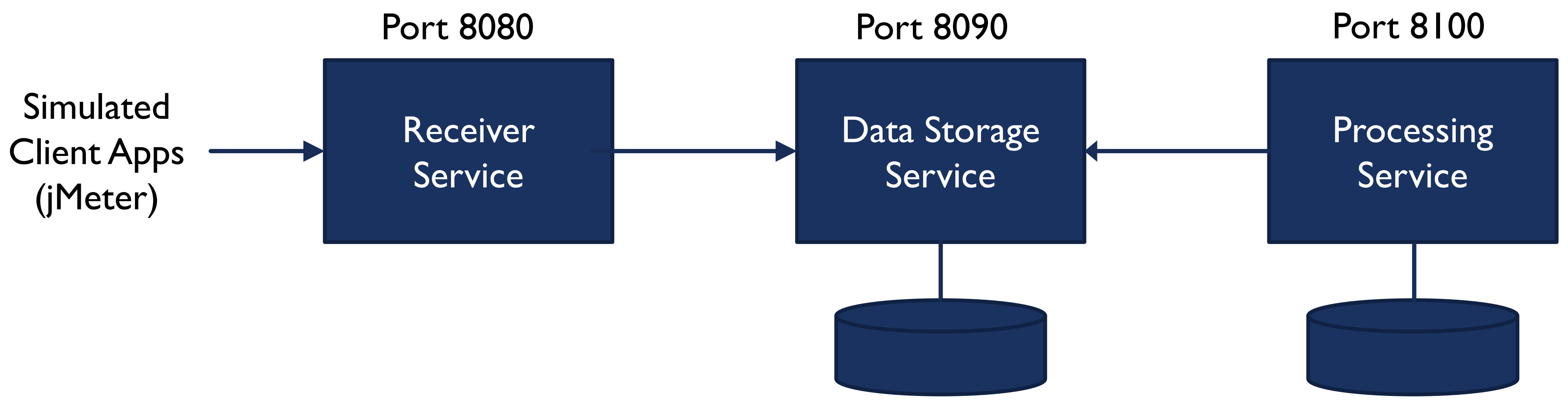
Your JSON file should consists of a single object with the latest statistics

It also needs the timestamp of the last time you calculated the statistics (last_updated).

This is needed to query for new events from the Storage Service.

THREE SERVICES RUNNING TOGETHER

- When demoing this lab, you will be running all three services at the same time (on different ports).
- When you run your jMeter test, you should see the Processing Service periodically generate new stats over the duration of the test.
- You should be able to call the GET /stats endpoint on the Processing Service to see the latest statistics.



TODAY'S TOOLS

RESTful API Specification: SwaggerHub and OpenAPI

- Define a RESTful API in a yaml format

RESTful API Implementation: Python connexion

- Built on top of Flask but allows integration with an OpenAPI specification

Configuration and Logging:

- Yaml for configuration
- Python logging module for tracing

Periodic Processing: apscheduler

- Allows scheduled calls to functions to be defined

Database: SQLAlchemy and MySQL and JSON

- SQLAlchemy and MySQL for the Storage Service
- JSON for the Processing Service

RESTful API Testing: PostMan and Apache jMeter

- Postman – same as ACIT 2515
- Apache jMeter – for load testing

You will be using these in your Lab today.

We may code some of this lab together.

TODAY'S LAB

The lab is to be submitted individually. Today you will:

- Demo your Lab 4 results
- Create a new Processing Service that collects and stores some statistics on your Events
  - The metrics should be cumulative and stored in a JSON file
  - You need to design the process_stats function which will calculate and update those statistics
- Test out all three of your services under load using your jMeter script