ASSIGNMENT – 1

Basics of Containers and Microservices
Course: COMP.SE.140 Continuous Development and Deployment – DevOps
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Purpose

The purpose of this document is to describe the activities and provide answer to asked questionaires.

Platform Information

Host Machine Type: Laptop
Processor: Core i5 8th Gen with Virtualization enabled
RAM: 32GB
Host OS: Windows 11 Pro
Virtualization Software: Hyper-V (Window's Built-in)
Guest OS: Ubuntu 22 LTS
Guest OS Kernel: Linux 6.8.0-84-generic
Docker Version: 28.4.0
Docker Compose Version: v2.39.4-desktop.1

Tools & Technologies

PHP, Groovy, JDK, Git, Visual Studio Code with Co-Pilot

Service Architecture Diagram

Here is the architecture diagram how services and data storage working:

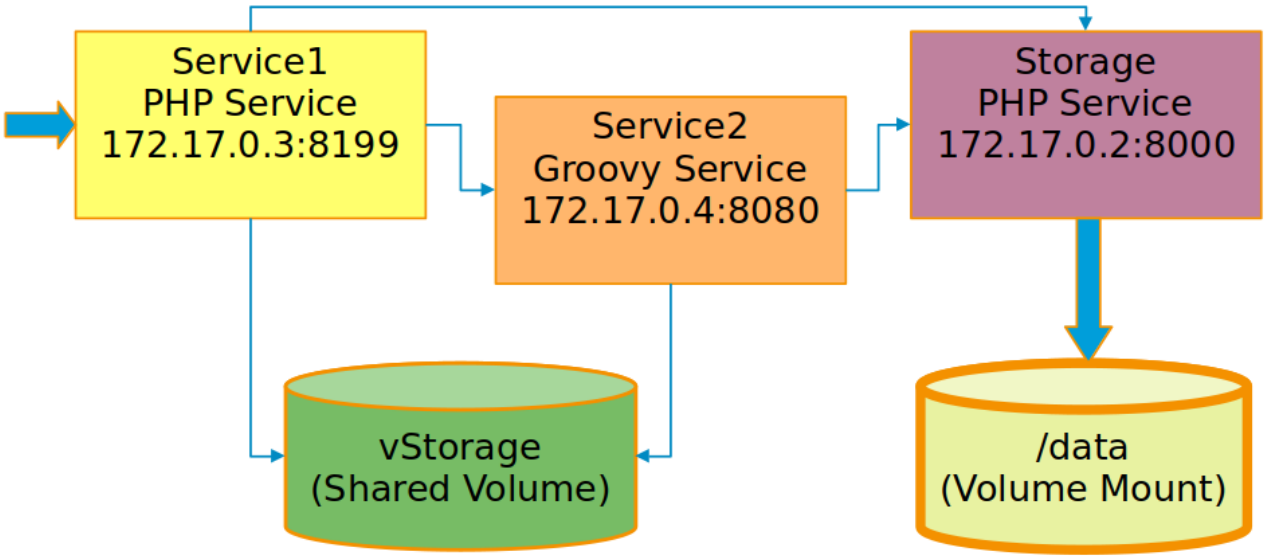

Figure: Architecture

Status Record Analysis

<u>Disc Space and Uptime Measurement</u>
@ Disk Space

- Measured: Free space in root directory
- Method: `*disk_free_space('/')*` in PHP, `*getFreeSpace()*` in Groovy
- Unit: MBytes
- Relevance: Measures container's filesystem

@ Uptime

- Measured: System uptime from /proc/uptime
- Method: Reading from /proc/uptime file
- Unit: Hours (with 2 decimal places)
- Relevance: Container uptime

Improvement Suggestions

@ Can include Free Space vs Total Available Space
@ Can include Container Statrt Time
@ Can include service health check status (if possible)
@ Service responsiveness monitoring plugins

Persistent Storage Solutions Analysis

Named Volume (storage_data)

@ Used by Storage Service (index.php)
Good side:

- Managed by Docker
- Better performance
- Portable across different environments

Bad side:

- Complicated manual backup

Bind Mount (vstorage)

@ Used by Service1 and Service2
Good side:

- Data visibility inside file
- Easy backup possible
- Directly editable text file

Bad side:

- Possible permission issues in linux

Instructions for Cleaning up the Persistent Storage

All instructions are given below to be executed on linux terminal with appropriate user privilege:
Step 1: Stopping all containers:
docker compose down
Step 2: Removing named volumes for clearing up storage
docker volume rm -f exercise_01_storage_data
Step 3: Removing vStorage
rm -f vstorage/storage.txt

Difficulties/Problems

@ Initially, my plan was to use Guest OS as Ubuntu 24 LTS and latest VirtualBox for virtualization. But no way, my attempt became successful to have KVM enabled in Guest OS for running Docker. Later I tried with VMWare Worstation Player but still no luck. As a final option, I attempted with Windows's built-in Hyper-V and successfully able to run Docker in Ubuntu 22 LTS.
@ I faced issue with dependency resolution for OpenJDK and Spark Framework for Groovy. Latest Groovy (version 5) has issue with OpenJDK and other plugins dependency as a result Groovy (version 3) is used with OpenJDK (version 11).

@ Dependency resolution for groovy also causing issue with latest version of Fedora linux.
@ At one point, Guest OS lost internet connectivity from Host OS. It was very complicated case and possible clue of the problem was not showing over internet search. Even internet configuration and connection were completely reset for the clue less problem. Later, on a search on Microsoft Co-Pilot, it suggested to create a new virtual switch for Guest OS in stead of Default Switch provided by Hyper-V.
@ Error handling while communicating between different services.
@ Permission issue in linux for creating/writing storage file