Home Lab Activity: Docker Containerization with Persistent Volumes

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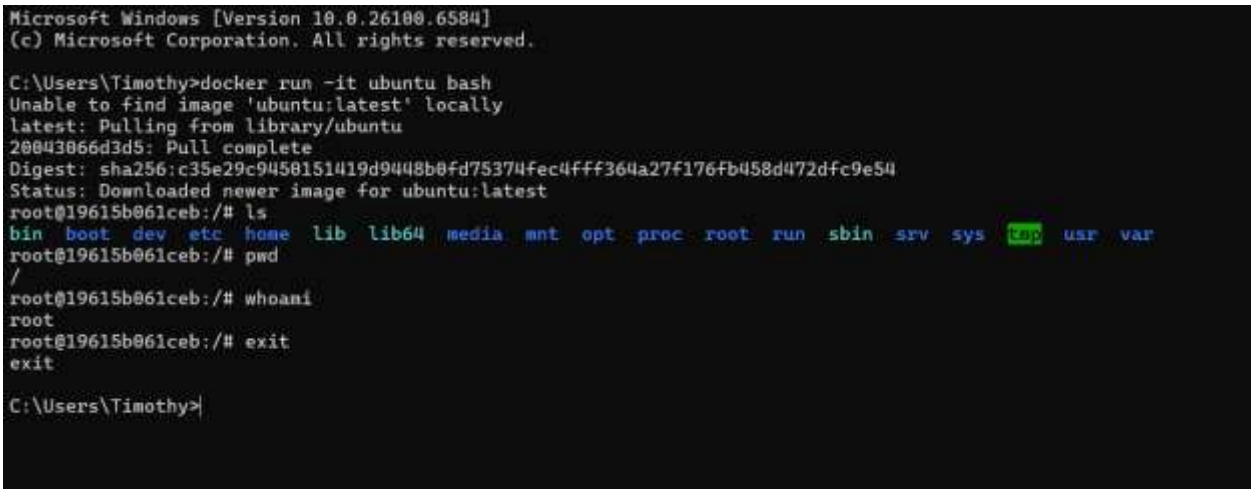
Course: Elective 3
Objective

This lab demonstrates understanding of containerization concepts by:

1. Accessing a running container's shell environment
2. Deploying a multi-container application (WordPress + MySQL)
3. Implementing persistent storage using Docker volumes

Part 1: Shell Access to Running Container



Explanation:

I successfully created and accessed an interactive Ubuntu container using the command docker run -it ubuntu bash. This command pulled the Ubuntu image from Docker Hub and launched a container with an interactive bash shell.

Inside the container, I executed basic Linux commands to explore the environment:

- ls - listed directory contents showing the root filesystem structure
- pwd - confirmed I was in the root directory (/)
- whoami - verified I was logged in as the root user

This demonstrates that containers provide isolated environments with their own filesystem, separate from the host operating system.

Part 2: WordPress and MySQL Deployment with Persistent Volumes

Explanation:

I created a docker-compose.yml file to define a multi-container application stack. This configuration file specifies two services:

MySQL Database Service:

- Uses mysql:8.0 image
- Environment variables configure database credentials
- Volume db_data:/var/lib/mysql ensures database persistence

WordPress Service:

- Uses wordpress:latest image
- Maps port 8080 on host to port 80 in container
- Volume wp_data:/var/www/html preserves WordPress files
- Depends on MySQL service for proper startup order

Key Configuration Elements:

- **Volumes:** Named volumes (db_data and wp_data) store data outside containers, ensuring persistence across restarts

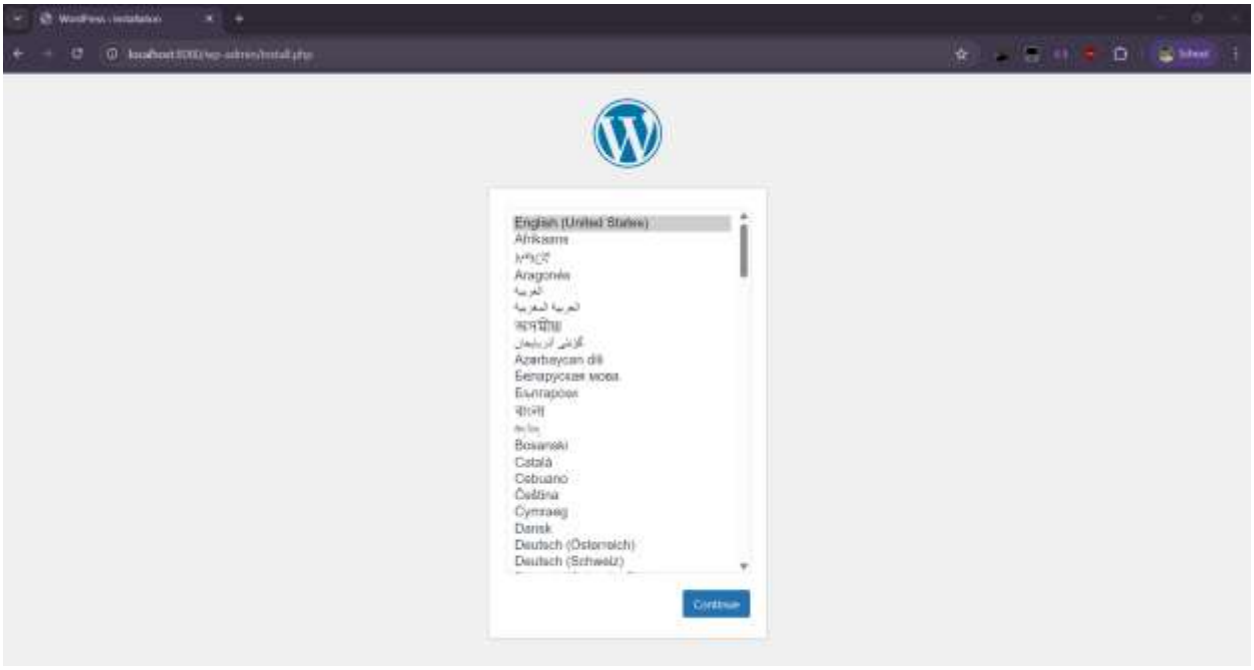
- **Networks:** Custom network (wp_network) enables container communication
- **Environment Variables:** Pass configuration securely without hardcoding in images

Explanation:

After running docker-compose up -d, I verified both containers were running using docker ps. The output shows:

- **mysql_db:** MySQL container running on port 3306
- **wordpress_site:** WordPress container with port mapping 8080→80

Both containers show "Up" status, confirming successful deployment. The -d flag runs containers in detached mode (background), allowing the terminal to remain available for other commands.

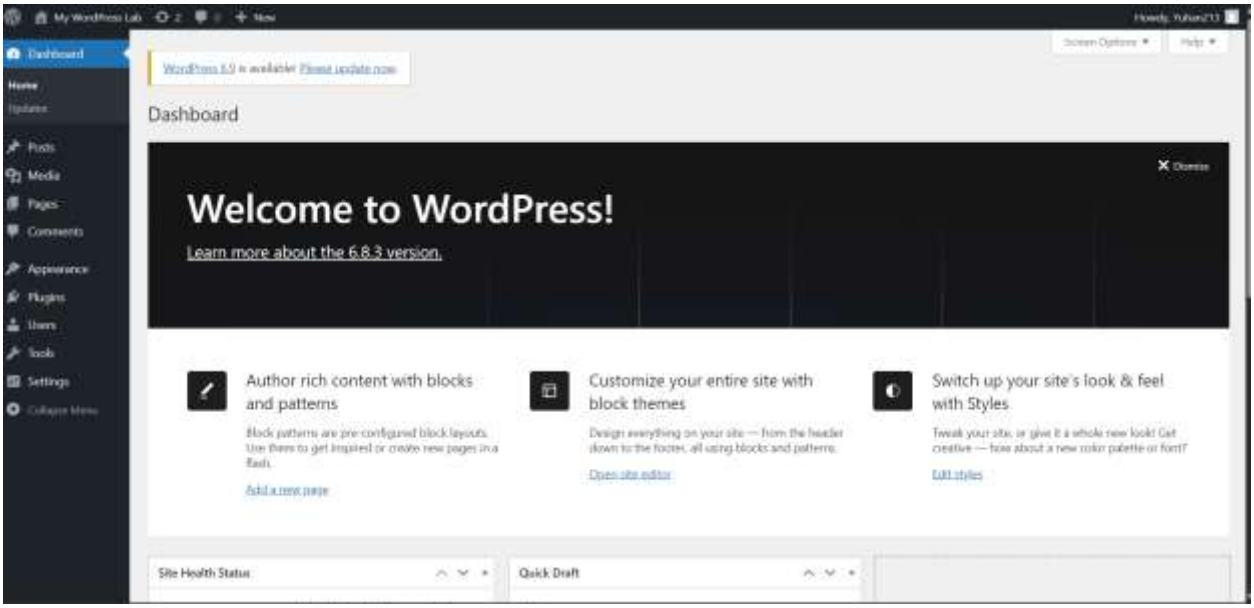


Explanation:

Accessing http://localhost:8080 in my browser displayed the WordPress installation page. This confirms:

1. The WordPress container is running correctly
2. Port mapping is working (host port 8080 → container port 80)
3. WordPress successfully connected to the MySQL database

The installation page allows configuration of site title, admin username, password, and email. This is the initial setup required before WordPress becomes fully functional.



Explanation:

After completing the installation, I successfully logged into the WordPress admin dashboard. This interface provides access to:

- Posts and Pages management
- Theme and plugin installation
- Site settings and configuration
- User management

Testing Persistent Storage:

To verify volume persistence, I performed the following test:

1. Stopped all containers: docker-compose down
2. Restarted containers: docker-compose up -d
3. Accessed http://localhost:8080 again

The WordPress site remained intact with all configurations preserved, confirming that the persistent volumes successfully stored data outside the containers.

Key Concepts Demonstrated

1. Containerization

Containers package applications with their dependencies, ensuring consistent behavior across different environments. Each container runs in isolation from the host system and other containers.

2. Persistent Volumes

By default, container data is ephemeral (lost when container stops). Named volumes solve this by storing data on the host filesystem, surviving container restarts and removals.

3. Multi-Container Orchestration

Docker Compose simplifies managing applications requiring multiple interconnected services. It handles startup order, networking, and configuration through a single YAML file.

4. Container Networking

The custom network (wp_network) allows WordPress to communicate with MySQL using the service name (db:3306) instead of IP addresses, providing service discovery.

Conclusion

This lab successfully demonstrated Docker containerization fundamentals. I deployed a production-ready WordPress application with persistent data storage, proving understanding of:

- Container lifecycle management
- Volume persistence mechanisms
- Multi-container application architecture
- Docker Compose orchestration

The persistent volumes ensured that even after stopping and restarting containers, all WordPress content and MySQL data remained intact, which is critical for real-world applications.