LAMP Stack (Apache2 + MariaDB) with Docker & Compose

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Target: Milestone 1 (baseline + extras)

1) Overview

This document shows a clean, reproducible setup of a containerized LAMP stack on Docker using:

- Apache 2 (Ubuntu 24.04 base, custom Dockerfile)
- MariaDB (official image)
- Docker Compose for orchestration æ It meets all required deliverables: web page reading a name from the DB, host persistence for web files and database, proof steps (update name → page updates; restart → data persists), and professional documentation with screenshots guidance.

Extras implemented:

- Health checks for both services
- Non-privileged user running Apache (custom user: webapp)

Container naming follows the spec:

- Apache: `contapa2-m1-WS`
- MariaDB: `contsql-m1-WS`

2) Repository Layout

```
project-root/
├─ docker-compose.yaml
├─ apache/
│  ├─ Dockerfile
│  └─ 000-default.conf              # HTTP vhost (port 80)
├─ web/                         # Mounted into /var/www/html (persistent)
│  ├─ index.php
│  └─ db.php
├─ db/
```

```
│   └─ init.sql                # Initializes DB + table + 1 record
└─ data/
    └─ mysql/                  # Host bind mount for MariaDB data dir
(persistent)
```

3) Docker Compose

File: `docker-compose.yaml`

```yaml
services:
  apache:
    container_name: contapa2-m1-WS
    cap_add:
      - NET_BIND_SERVICE
    build:
      context: ./apache
    depends_on:
      db:
        condition: service_healthy
    ports:
      - "8085:80"     # HTTP
    environment:
      DB_HOST: contsql-m1-WS
      DB_NAME: milestone
      DB_USER: appuser
      DB_PASSWORD: apppass
    volumes:
      - ./web:/var/www/html
    healthcheck:
      # Check PHP + Apache + DB connectivity via a lightweight endpoint
      test: ["CMD", "curl", "-fsS", "http://localhost"]
      interval: 10s
      timeout: 3s
      retries: 3
      start_period: 20s

  db:
    container_name: contsql-m1-WS
    image: mariadb:11.4
    environment:
      MARIADB_ROOT_PASSWORD: rootpass
      MARIADB_DATABASE: milestone
      MARIADB_USER: appuser
      MARIADB_PASSWORD: apppass
    volumes:
      - ./data/mysql:/var/lib/mysql
      - ./db/init.sql:/docker-entrypoint-initdb.d/01-init.sql:ro
    healthcheck:
      # MariaDB official images provide healthcheck.sh
      test: ["CMD", "healthcheck.sh", "--su-mysql", "--connect", "--innodb_initialized"]
      interval: 10s
      timeout: 5s
      retries: 5
```

Explanation of key options

- `container_name` : matches the exact naming requirement.
- `depends_on.condition` : service_healthy: waits until DB is healthy before starting Apache.
- `ports` : exposes HTTP 8085.
- `environment` : passes DB connection vars to PHP.
- `volumes` : ensures web files and DB data persist on the host.
- `healthcheck` (Apache): probes http://localhost inside the container.
- `healthcheck` (MariaDB): uses the built-in script to verify the DB is ready.

4) Apache Dockerfile (Ubuntu 24.04, non-root, HTTPS)

File: `apache/Dockerfile`

```
FROM ubuntu:24.04

ARG DEBIAN_FRONTEND=noninteractive

# Install Apache, PHP, and required tools
RUN apt-get update && \
    apt-get install -y --no-install-recommends \
      apache2 \
      php \
      php-mysql \
      libapache2-mod-php \
      curl \
      ca-certificates && \
    rm -rf /var/lib/apt/lists/*

# Enable needed Apache modules (no SSL)
RUN a2enmod rewrite

# Create non-root user and set permissions
# - UID 1001 for webapp
# - Add to www-data group
# - Ensure Apache runtime and web dirs are writable
RUN useradd -m -u 1001 webapp && \
    usermod -a -G www-data webapp && \
    mkdir -p /var/run/apache2 /var/lock/apache2 /var/log/apache2 /var/www/html && \
    chown -R webapp:www-data /var/run/apache2 /var/lock/apache2 /var/log/apache2 /var/www/html

# Make Apache drop privileges to webapp
RUN sed -ri 's/^export APACHE_RUN_USER=.*/export APACHE_RUN_USER=webapp/' /etc/apache2/envvars && \
    sed -ri 's/^export APACHE_RUN_GROUP=.*/export APACHE_RUN_GROUP=www-data/' /etc/apache2/envvars

# Site config
COPY 000-default.conf /etc/apache2/sites-available/000-default.conf

EXPOSE 80

# Run as non-root
USER webapp

# Start Apache
CMD ["apache2ctl", "-D", "FOREGROUND"]
```

Why this is secure/best practice

- Non-root: Apache processes run as webapp with limited privileges.
- Modules: Only necessary modules enabled (PHP, SSL, rewrite).
- Permissions: webapp:www-data with 775 to allow Apache to read/write as needed.

5) Apache VirtualHost configs

File: apache/apache.conf (HTTP on 80)

```
<VirtualHost *:80>
    ServerAdmin webmaster@localhost
    DocumentRoot /var/www/html

    <Directory /var/www/html>
        AllowOverride All
        Require all granted
    </Directory>

    ErrorLog ${APACHE_LOG_DIR}/error.log
    CustomLog ${APACHE_LOG_DIR}/access.log combined
</VirtualHost>
```

7) PHP app (reads name from DB)

File: web/db.php

```
<?php
$host = getenv('DB_HOST') ?: 'contsql-m1-WS';
$db   = getenv('DB_NAME') ?: 'milestone';
$user = getenv('DB_USER') ?: 'appuser';
$pass = getenv('DB_PASSWORD') ?: 'apppass';

$mysqli = @new mysqli($host, $user, $pass, $db);
if ($mysqli->connect_errno) {
    http_response_code(500);
    die("DB connection failed: " . $mysqli->connect_error);
}
```

File: web/index.php

```
<?php
require __DIR__ . '/db.php';
$result = $mysqli->query("SELECT full_name FROM student LIMIT 1");
$row = $result ? $result->fetch_assoc() : null;
$name = $row ? $row['full_name'] : 'Unknown Student';
?>
<!doctype html>
<html lang="en">
```

```
<head>
  <meta charset="utf-8">
  <meta name="viewport" content="width=device-width, initial-scale=1">
  <title>Milestone 1</title>
  <style>
    body { font-family: system-ui, sans-serif; margin: 2rem; }
    .box { padding: 1.5rem; border: 1px solid #ddd; border-radius: 12px; }
    .ok { color: #0a7; }
  </style>
</head>
<body>
  <div class="box">
    <h1><?php echo htmlspecialchars($name); ?> has reached Milestone 1!!</h1>
    <p class="ok">DB-backed message (not hard-coded).</p>
    <p>
      HTTP: <a href="http://localhost:8085/">localhost:8085</a> |
      HTTPS: <a href="https://localhost:8443/">localhost:8443</a> (self-signed; accept warning)
    </p>
  </div>
</body>
</html>
```

8) Database init script

File: db/init.sql

```
CREATE TABLE IF NOT EXISTS student (
  id INT PRIMARY KEY AUTO_INCREMENT,
  full_name VARCHAR(255) NOT NULL
);

INSERT INTO student (full_name) VALUES ('Wout Struys');
```

9) Build & Run

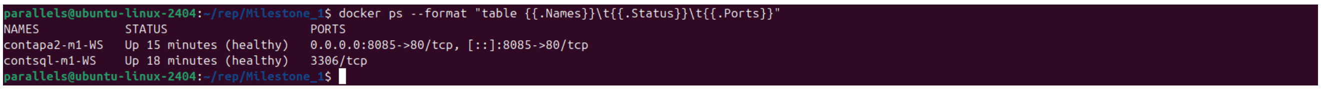
One-time setup

```
# From project root
mkdir -p data/mysql web certs
```

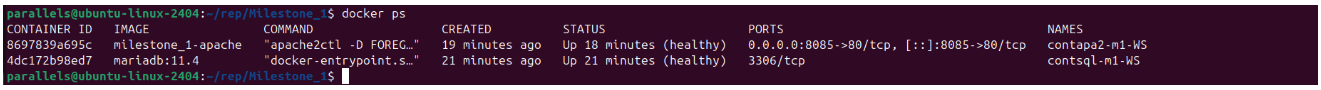
```
# Build and start
docker compose up -d --build

# Check status (health should become healthy)
docker ps --format "table {{.Names}}\t{{.Status}}\t{{.Ports}}"
```

Show ports mapping



```
parallels@ubuntu-linux-2404:~/rep/Milestone_1$ docker ps --format "table {{.Names}}\t{{.Status}}\t{{.Ports}}"
NAMES            STATUS                   PORTS
contapa2-m1-WS   Up 15 minutes (healthy)  0.0.0.0:8085->80/tcp, [::]:8085->80/tcp
contsql-m1-WS    Up 18 minutes (healthy)  3306/tcp
parallels@ubuntu-linux-2404:~/rep/Milestone_1$
```



```
parallels@ubuntu-linux-2404:~/rep/Milestone_1$ docker ps
CONTAINER ID   IMAGE                 COMMAND                  CREATED          STATUS                    PORTS                                     NAMES
8697839a695c   milestone_1-apache    "apache2ctl -D FOREG…"   19 minutes ago   Up 18 minutes (healthy)   0.0.0.0:8085->80/tcp, [::]:8085->80/tcp   contapa2-m1-WS
4dc172b98ed7   mariadb:11.4          "docker-entrypoint.s…"   21 minutes ago   Up 21 minutes (healthy)   3306/tcp                                  contsql-m1-WS
parallels@ubuntu-linux-2404:~/rep/Milestone_1$
```

Visit the site

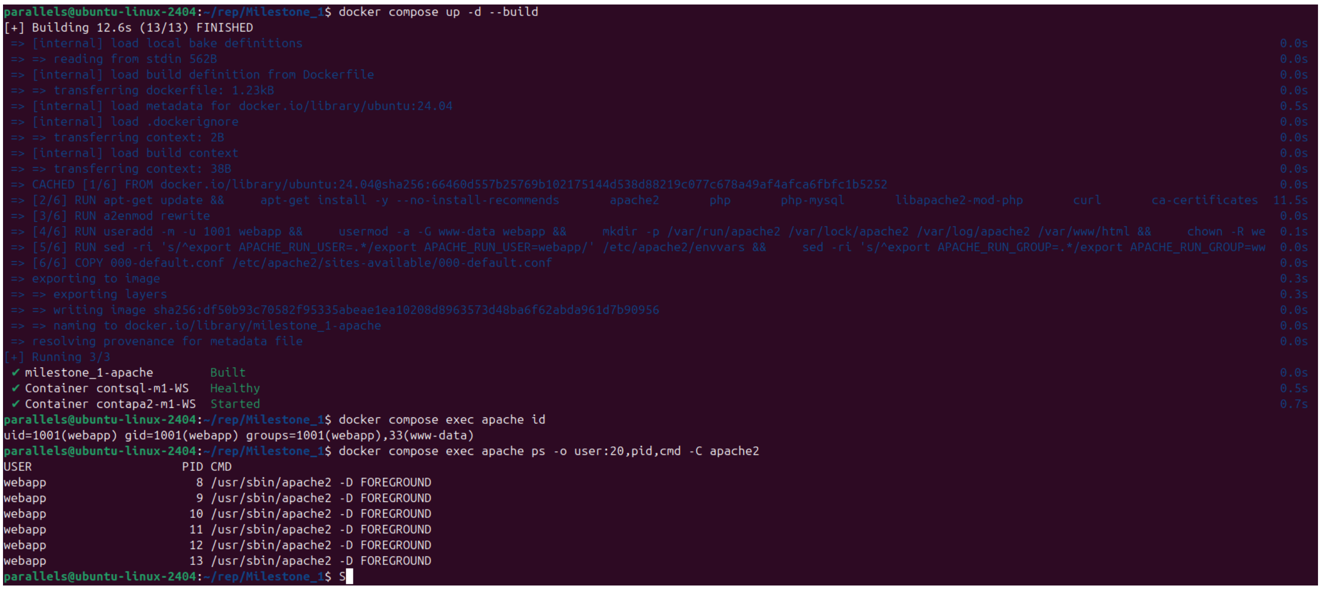
- HTTP: http://localhost:8085

Verify non-privileged user (proof)

```
docker compose exec apache id
# uid=10001(webapp) gid=33(www-data) groups=33(www-data)

docker compose exec apache bash -lc 'ps -o user:20,pid,cmd -C apache2'
# USER                   PID CMD
# webapp               <pid> /usr/sbin/apache2 -D FOREGROUND
# ... (children as webapp)
```

User running Apache: `webapp` (uid 1001)



```
parallels@ubuntu-linux-2404:~/rep/Milestone_1$ docker compose up -d --build
[+] Building 12.6s (13/13) FINISHED
 => [internal] load local bake definitions                                                                                                                                          0.0s
 => => reading from stdin 562B                                                                                                                                                      0.0s
 => [internal] load build definition from Dockerfile                                                                                                                                0.0s
 => => transferring dockerfile: 1.23kB                                                                                                                                              0.0s
 => [internal] load metadata for docker.io/library/ubuntu:24.04                                                                                                                     0.5s
 => [internal] load .dockerignore                                                                                                                                                   0.0s
 => => transferring context: 2B                                                                                                                                                     0.0s
 => [internal] load build context                                                                                                                                                   0.0s
 => => transferring context: 38B                                                                                                                                                    0.0s
 => CACHED [1/6] FROM docker.io/library/ubuntu:24.04@sha256:66460d557b25769b102175144d538d88219c077c678a49af4afca6fbfc1b5252                                                      0.0s
 => [2/6] RUN apt-get update &&     apt-get install -y --no-install-recommends       apache2       php       php-mysql       libapache2-mod-php       curl       ca-certificates  11.5s
 => [3/6] RUN a2enmod rewrite                                                                                                                                                       0.0s
 => [4/6] RUN useradd -m -u 1001 webapp &&     usermod -a -G www-data webapp &&     mkdir -p /var/run/apache2 /var/lock/apache2 /var/log/apache2 /var/www/html &&     chown -R we  0.1s
 => [5/6] RUN sed -ri 's/^export APACHE_RUN_USER=.*/export APACHE_RUN_USER=webapp/' /etc/apache2/envvars &&     sed -ri 's/^export APACHE_RUN_GROUP=.*/export APACHE_RUN_GROUP=ww  0.0s
 => [6/6] COPY 000-default.conf /etc/apache2/sites-available/000-default.conf                                                                                                       0.0s
 => exporting to image                                                                                                                                                              0.3s
 => => exporting layers                                                                                                                                                             0.3s
 => => writing image sha256:df50b93c70582f95335abeae1ea10208d8963573d48ba6f62abda961d7b90956                                                                                        0.0s
 => => naming to docker.io/library/milestone_1-apache                                                                                                                               0.0s
 => resolving provenance for metadata file                                                                                                                                          0.0s
[+] Running 3/3
 ✔ milestone_1-apache        Built                                                                                                                                                  0.0s
 ✔ Container contsql-m1-WS   Healthy                                                                                                                                                0.5s
 ✔ Container contapa2-m1-WS  Started                                                                                                                                                0.7s
parallels@ubuntu-linux-2404:~/rep/Milestone_1$ docker compose exec apache id
uid=1001(webapp) gid=1001(webapp) groups=1001(webapp),33(www-data)
parallels@ubuntu-linux-2404:~/rep/Milestone_1$ docker compose exec apache ps -o user:20,pid,cmd -C apache2
USER                     PID CMD
webapp                     8 /usr/sbin/apache2 -D FOREGROUND
webapp                     9 /usr/sbin/apache2 -D FOREGROUND
webapp                    10 /usr/sbin/apache2 -D FOREGROUND
webapp                    11 /usr/sbin/apache2 -D FOREGROUND
webapp                    12 /usr/sbin/apache2 -D FOREGROUND
webapp                    13 /usr/sbin/apache2 -D FOREGROUND
parallels@ubuntu-linux-2404:~/rep/Milestone_1$ $
```

10) Proof Steps (for ≤ 1-minute video)

A) Change name in DB → refresh page shows change

```
# Enter DB shell
docker exec -it contsql-m1-WS mariadb -uroot -prootpass milestone -e "UPDATE student SET full_name='Wout Video Test' WHERE id=1;"
# Now refresh http://localhost:8085 → text updates immediately
```

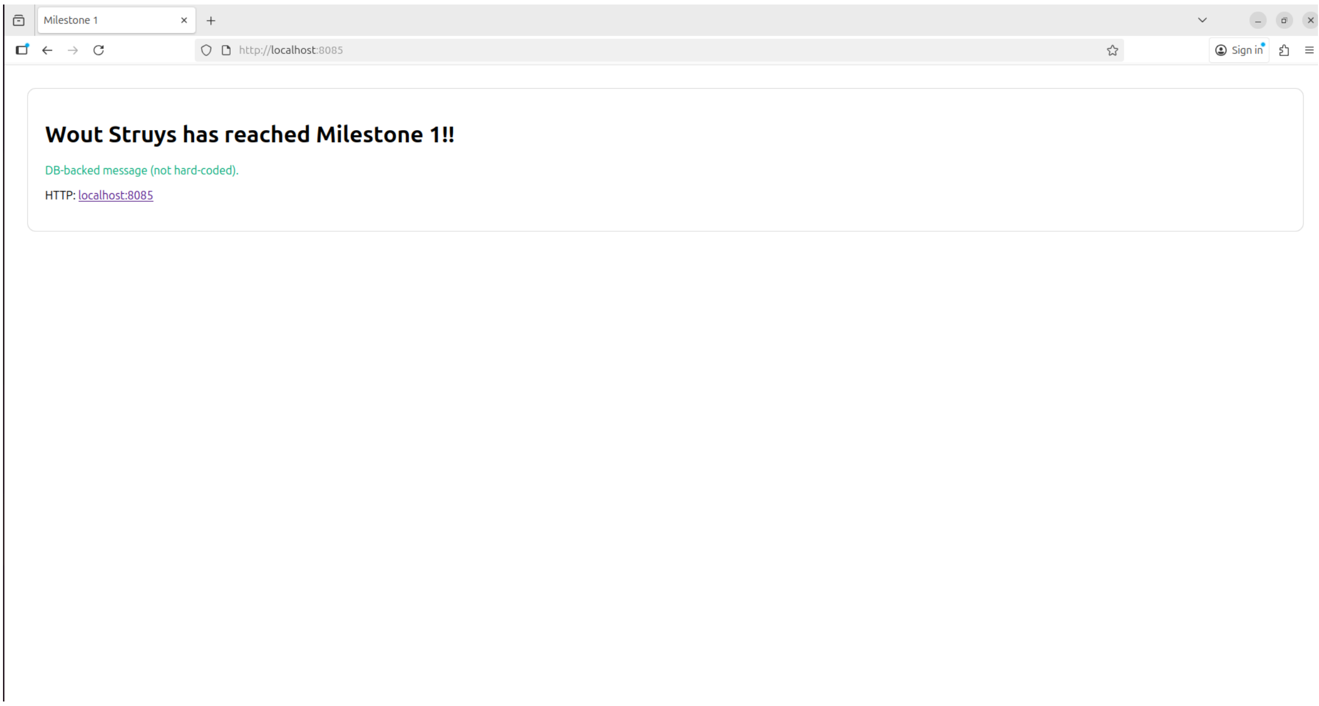
B) Remove & restart the stack → data persists

```
# Stop and remove containers (data on host persists)
docker compose down

# Start again
docker compose up -d

# Refresh the page → should still show "Wout Video Test"
```

Webpage with name from DB

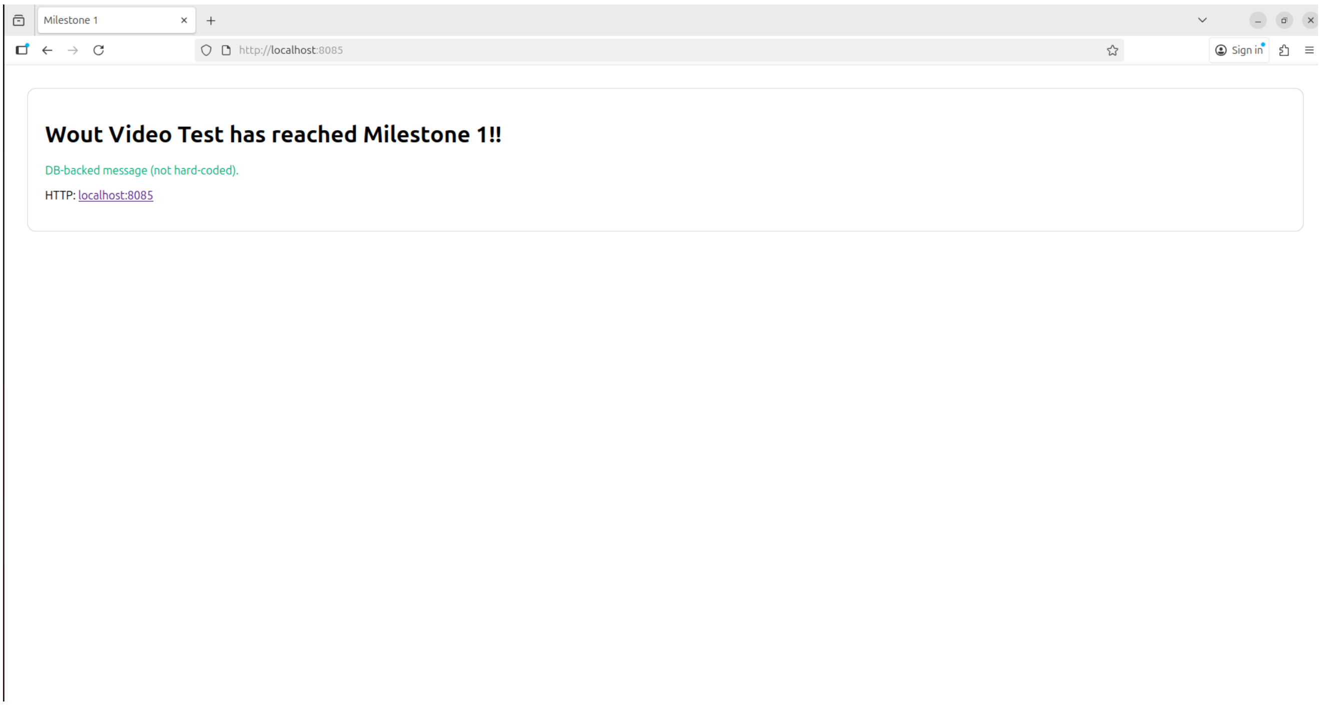


Wout Struys has reached Milestone 1!!

DB-backed message (not hard-coded).

HTTP: localhost:8085

Webpage after restart (data persists)



Wout Video Test has reached Milestone 1!!

DB-backed message (not hard-coded).

HTTP: localhost:8085

Video is in `Milestone_1_Proof.mov`

11) Generative AI (Prompts & Responses) & Reflection

Prompts are in `AI_Prompt.md` or `AI_Prompt.pdf`.

I use ChatGPT to get the draft you see in the AI_Prompt.md file. I made some changes and corrections to the README.md. The code itself was mostly accurate from the start, I only removed the part about encrypted HTTPS as I could not get it to work.

12) Conclusion

You now have a fully containerized LAMP stack that: • Serves a PHP page on 8085 that reads from MariaDB. • Stores web content and database data on the host (persistence proven across restarts). • Implements health checks, non-root execution.