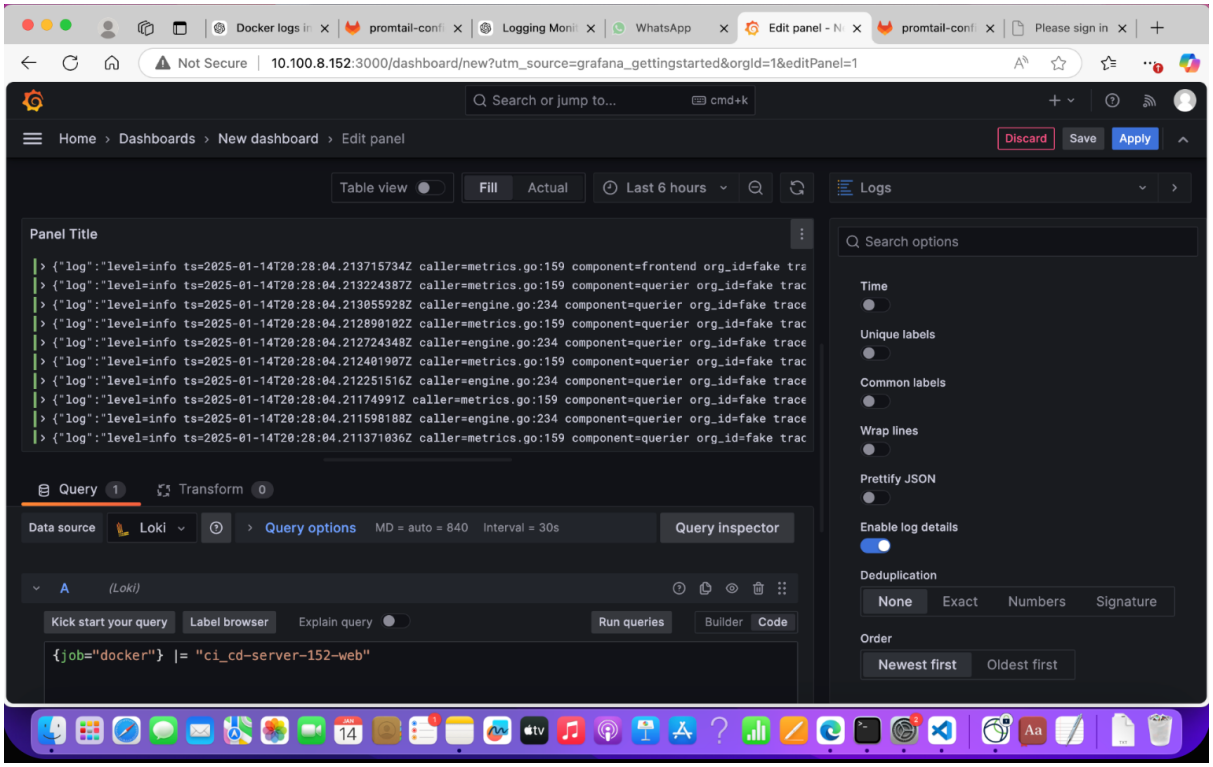
New Features: Logging and Monitoring Stack

This branch introduces a comprehensive logging and monitoring solution to centralize application logs and visualize system health.



Here's a breakdown of what the screenshot shows:

1. **Grafana Dashboard Interface**: The overall layout is that of a Grafana dashboard, a popular open-source platform for analytics and monitoring. It features navigation, a panel title, time range selector ("Last 6 hours"), and query input fields.
2. **Loki Data Source**: In the bottom left, the "Data source" dropdown clearly shows "Loki" selected. This confirms that Grafana is configured to pull log data from your Loki instance.
3. **Log Query**: The query being executed is:
4. `{job="docker"} |= "ci_cd-server-152-web"`
    - `{job="docker"}`: This part of the query targets logs that have been labeled with `job="docker"`. As previously documented, Promtail is configured to add this label to logs collected from Docker containers.
    - `|= "ci_cd-server-152-web"`: This is a line filter that searches for log entries containing the string "ci_cd-server-152-web". This string likely corresponds to the container name or a label associated with your Spring Boot application's Docker container, indicating that the query is specifically trying to retrieve logs from your web application.
5. **Displayed Logs**: The "Panel Title" area displays several log lines. While the query explicitly filters for "ci_cd-server-152-web", the displayed log lines show entries like `caller=metrics.go`, `component=frontend`, `caller=engine.go`, `component=querier`, and `org_id=fake trac`. These specific lines suggest that the panel might be showing internal logs from Loki itself or another component of the

monitoring stack (like Grafana's internal metrics), or that the "ci_cd-server-152-web" string might appear in these system-level logs as part of a larger context. In a typical setup, you would expect to see the actual application logs (e.g., Spring Boot INFO/ERROR messages, custom log statements) from your `MyFirstTodoApp` here.

6. **Query Options and Controls**: The right panel offers various options such as "Time", "Unique labels", "Common labels", "Wrap lines", "Prettify JSON", "Enable log details", "Deduplication", and "Order". These allow users to refine their log views, analyze log patterns, and manage how logs are presented.

Significance: This screenshot visually confirms that the logging and monitoring stack you've integrated is operational:

- **Promtail** (implicitly, by providing logs with `job="docker"` labels) is successfully collecting logs from your Docker environment.
- **Loki** is receiving and storing these logs.
- **Grafana** is able to connect to Loki as a data source and query the aggregated logs, providing a centralized interface for troubleshooting and observation.

This demonstrates a critical aspect of the `feature-logs-monitoring` branch: improved observability through centralized log management.

1. Application Logging Configuration (`logging.properties`)

- **Purpose**: This file configures the Java standard logging (JUL) for the Spring Boot application.
- **Details**:
  - `handlers=java.util.logging.ConsoleHandler`: Specifies that log messages should be sent to the console.
  - `java.util.logging.ConsoleHandler.level=INFO`: Sets the minimum logging level for the console handler to `INFO`.
  - `java.util.logging.ConsoleHandler.formatter=java.util.logging.SimpleFormatter`: Uses a simple, single-line format for log messages.
  - `.level=INFO`: Sets the default logging level for all loggers to `INFO`.

2. Updated Application Dockerfile (`Dockerfile`)

The main application's `Dockerfile` has been updated to integrate with the new logging setup.

- **Logging Properties Inclusion**:

  Dockerfile

  ```
  COPY logging.properties /app/logging.properties
  ```

  - This line explicitly copies the `logging.properties` file into the `/app` directory within the Docker image.
- **Runtime Logging Configuration**:

Dockerfile

```
ENTRYPOINT ["java", "-
Djava.util.logging.config.file=/app/logging.properties", "-jar",
"target/MyFirstTodoApp-0.0.1-SNAPSHOT.jar"]
```

  - The `ENTRYPOINT` command now includes `-Djava.util.logging.config.file=/app/logging.properties`. This tells the Java Virtual Machine (JVM) to use the provided `logging.properties` file for its logging configuration at runtime, ensuring that the application's console output is formatted and handled as intended, which can then be collected by Promtail.
- **Dependency Installation Updates**:
  - The `apt-get install` command now includes `openjdk-11-jre-headless` which seems redundant as the base image is already openjdk-17, but it explicitly ensures a JRE is present.
  - It also adds `--allow-insecure-repositories --allow-releaseinfo-change` to `apt-get update` for potentially broader compatibility in certain network setups, and more aggressive cache cleanup `apt-get clean && rm -rf /var/cache/apt/* /var/lib/apt/lists/* /tmp/* /var/tmp/*`.

3. Loki (Log Aggregation)

Loki is a horizontally scalable, highly available, multi-tenant log aggregation system inspired by Prometheus.

- **Loki Dockerfile (`Dockerfile.loki`)**:

  Dockerfile

```
FROM grafana/loki:2.9.0
USER root
RUN mkdir -p /data /wal /tmp/loki/index /tmp/loki/chunks && \
    chmod -R 777 /data /wal /tmp/loki
USER 10001
COPY loki-config.yaml /etc/loki/local-config.yml
CMD ["-config.file=/etc/loki/local-config.yml"]
```

  - **Base Image**: Uses the official `grafana/loki:2.9.0` image.
  - **Permissions**: Temporarily switches to `root` to create necessary directories (`/data`, `/wal`, `/tmp/loki/index`, `/tmp/loki/chunks`) and set `777` permissions to ensure Loki has write access to its storage locations. It then switches back to Loki's default user for security.
  - **Configuration Copy**: Copies the `loki-config.yaml` file into the container at `/etc/loki/local-config.yml`.
  - **Command**: Sets the default command to start Loki using this copied configuration file.
- **Loki Configuration (`loki-config.yaml`)**:
  - **`auth_enabled: false`**: Disables authentication for simplicity, suitable for local development or trusted environments.

- **`server.http_listen_port: 3100`**: Loki listens for incoming log streams (from Promtail) on port `3100`.
- **Storage Configuration**: Configures Loki to use `boltdb-shipper` for index storage and `filesystem` for chunk storage. This means logs and their indices will be stored directly on the container's filesystem within the `/tmp/loki` directory.
- **Limits**: Sets various limits, including `reject_old_samples_max_age` (168h or 7 days), defining how long old log samples are rejected.
- **Retention**: `retention_deletes_enabled: false` and `retention_period: 0s` indicate that log retention/deletion is not actively managed by Loki in this configuration.

4. Promtail (Log Collector)

Promtail is an agent that ships the contents of local logs to a private Loki instance or other compatible systems.

- **Promtail Dockerfile (`Dockerfile.promtail`)**:

  Dockerfile

  ```
  FROM grafana/promtail:2.9.0
  COPY promtail-config.yaml /etc/promtail/config.yml
  CMD ["-config.file=/etc/promtail/config.yml"]
  ```

  - **Base Image**: Uses the official `grafana/promtail:2.9.0` image.
  - **Configuration Copy**: Copies `promtail-config.yaml` to `/etc/promtail/config.yml`.
  - **Command**: Sets the default command to start Promtail with this configuration.
- **Promtail Configuration (`promtail-config.yaml`)**:
  - **`clients.url: http://loki:3100/loki/api/v1/push`**: Defines the endpoint where Promtail will send collected logs. It targets the `loki` service within the Docker Compose network on port `3100`.
  - **`scrape_configs`**: Defines how Promtail discovers and collects logs.
    - `job_name: docker`: A job named `docker` for collecting container logs.
    - `__path__: /var/lib/docker/containers/*/*.log`: This crucial setting tells Promtail to look for log files in the standard Docker container log directory. It collects logs from all containers on the host.
    - `labels: job: docker`: Adds a `job: docker` label to all collected logs, enabling filtering and querying in Loki.

5. Docker Compose Enhancements (`docker-compose.yml`)

The `docker-compose.yml` file has been significantly expanded to include the logging and monitoring stack.

- **New Services Added**:
  - **`loki`**:

        - `build`: Uses the `Dockerfile.loki` to build Loki's image.
        - `ports: - "3100:3100"`: Exposes Loki's HTTP API port.
        - `networks: - app-network`: Connects Loki to the application network.
    - **`promtail`**:
        - `build`: Uses the `Dockerfile.promtail` to build Promtail's image.
        - `volumes`: This is critical:
            - `- /var/lib/docker/containers:/var/lib/docker/containers`: Mounts the host's Docker container log directory into Promtail's container, allowing Promtail to read application logs.
            - `- /var/run/docker.sock:/var/run/docker.sock`: Mounts the Docker daemon socket, enabling Promtail to get metadata (like container names and IDs) for log labeling.
        - `depends_on: - loki`: Ensures Loki is running before Promtail attempts to send logs.
        - `networks: - app-network`: Connects Promtail to the application network.
    -
    - **`grafana`**:
        - `image: grafana/grafana:9.5.3`: Uses a specific Grafana image version.
        - `ports: - "3000:3000"`: Exposes Grafana's web UI port.
        - `depends_on: - loki`: Ensures Loki is available for Grafana to connect to as a data source.
        - `networks: - app-network`: Connects Grafana to the application network.
- **Web Service Logging Driver**:
    - The `web` service now explicitly configures its logging driver to `loki`. This is important for directing the `web` container's logs directly to Loki, bypassing the need for Promtail to scrape them from files in this specific case.

      YAML

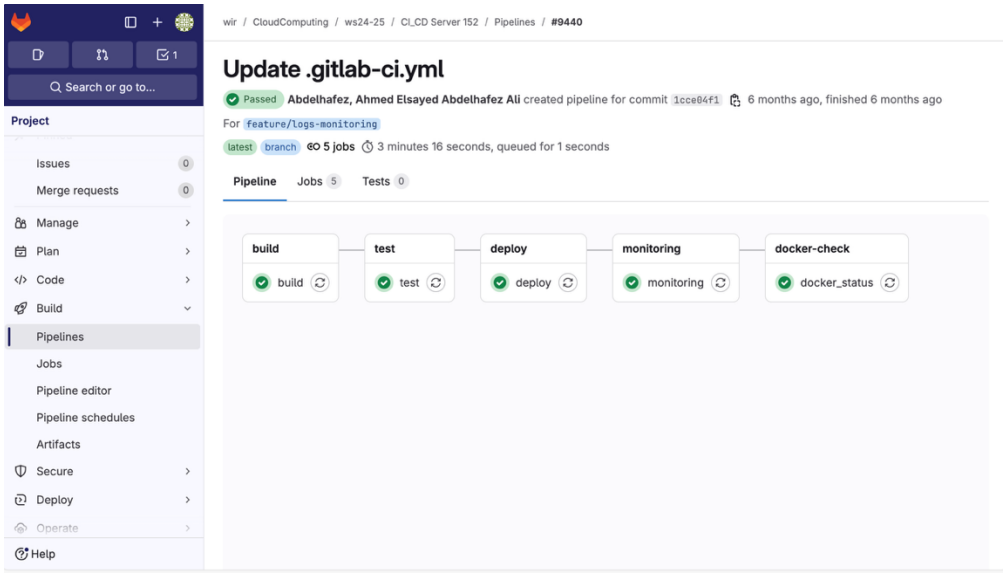
      ```
      logging:
        driver: loki
        options:
          loki-url: "http://loki:3100/loki/api/v1/push"
          loki-external-labels: application=my-first-todo-
      app,job=containerlogs
      ```

    - `loki-url`: Specifies the Loki endpoint.
    - `loki-external-labels`: Adds useful labels (`application` and `job`) to logs from the `web` service, making them easily queryable in Grafana.

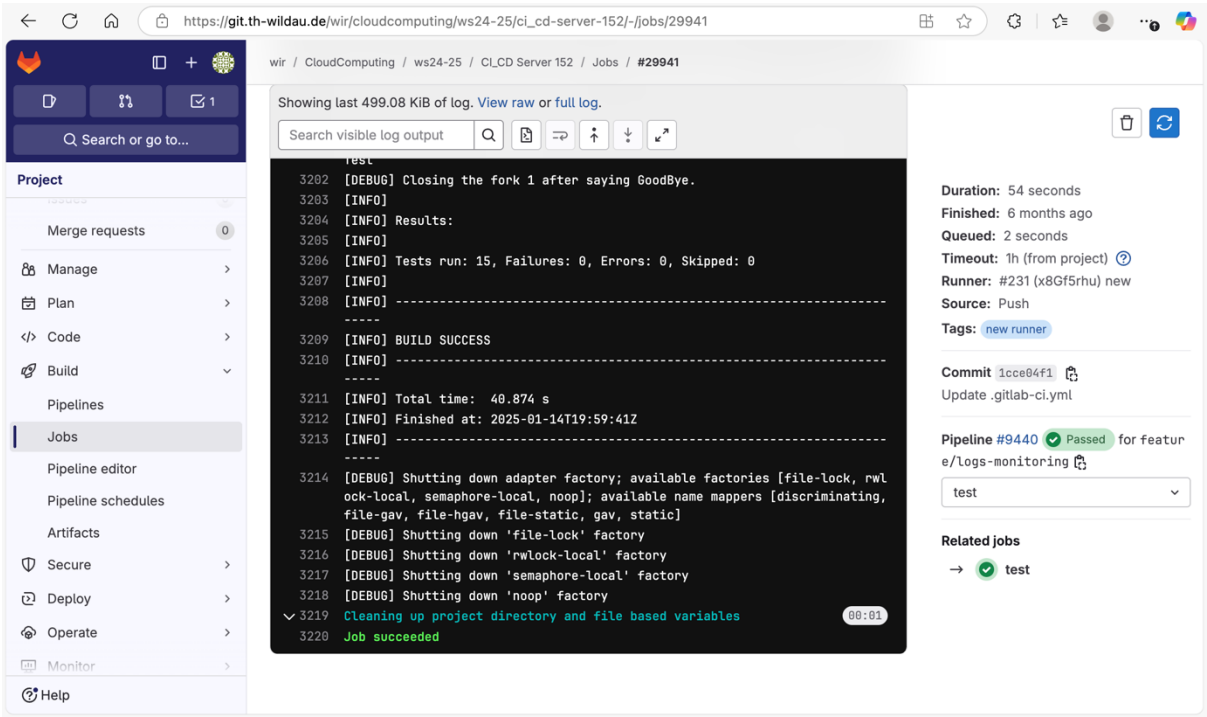
6. GitLab CI/CD Pipeline Updates (`.gitlab-ci.yml`)

The GitLab CI pipeline now includes dedicated stages and jobs for managing the monitoring stack.

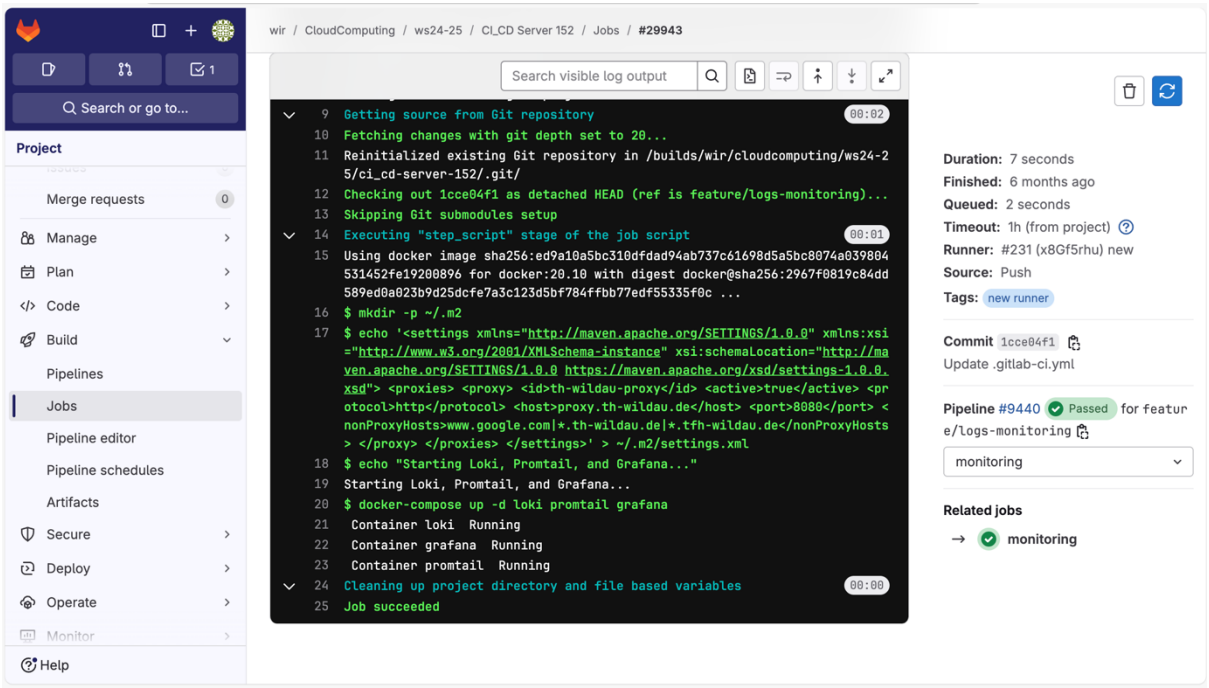
- **New Stages**:
  - `monitoring`: For deploying the Loki, Promtail, and Grafana services.
  - `docker-check`: For verifying the status of the deployed Docker containers.



- **Job Additions**:
  - **`build` Stage Job**:
    - Added `docker system prune -f || true` at the beginning of the script. This forcefully removes unused Docker data (containers, images, networks, volumes) before building, ensuring a clean build environment and preventing disk space issues on runners.
  - **`test` Stage Job (Unified `test` job, no longer split into `unit_tests` and `integration_tests` as in `main 3`)**:
    - This branch consolidates the `unit_tests` and `integration_tests` from `main 3` into a single `test` job.
    - It still includes the `mariadb` service and the wait loop to ensure the database is ready for integration tests.
    - The `script` now uses `mvn test -e -X`, which provides extended error reporting and debug output.



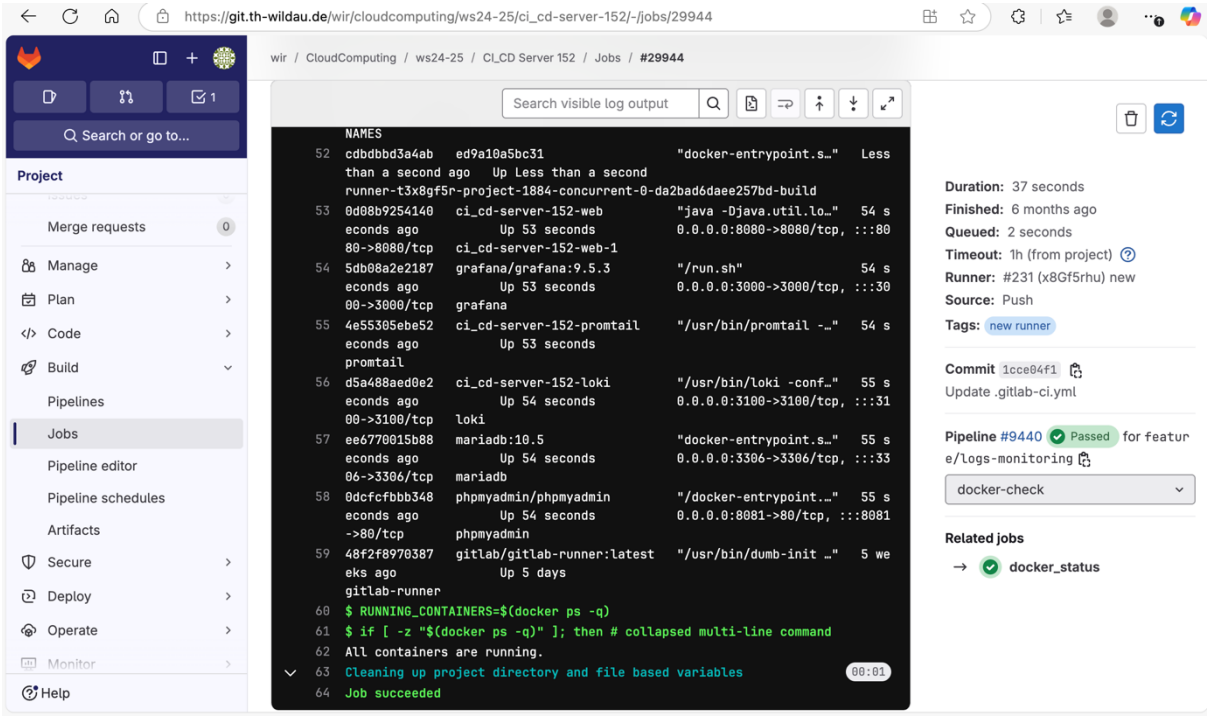
- **`monitoring` Stage Job**:
  - **`job: monitoring`**: A new job dedicated to bringing up the monitoring stack.
  - **`script: docker-compose up -d loki promtail grafana`**: This command selectively starts only the `loki`, `promtail`, and `grafana` services defined in `docker-compose.yml`. This allows deploying the monitoring stack independently or as part of the main application deployment.
  - **`tags: new runner`**: Specifies runner tag.



- **`docker_status` Stage Job**:
  - **`job: docker_status`**: A new job to verify the health of Docker containers after deployment.
  - **`services: - docker:dind`**: Requires Docker in Docker to run Docker commands.
  - **`script`**:
    - `docker ps`: Lists currently running containers.
    - Includes a check `if [ -z "$(docker ps -q)" ]; then ...` to ensure at least one container is running. If no containers are found, it prints an error and exits with a non-zero status, failing

the CI/CD job. This acts as a basic health check for the Docker services.

- `tags: new runner`: Specifies runner tag.



These new additions dramatically enhance the observability of the application by providing centralized logging and a platform for visualization, all integrated seamlessly into the automated CI/CD pipeline.