Logging Best Practices in Spring Boot

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Logging is a crucial part of any application. It helps developers monitor and debug applications during development, testing, and production. This document provides guidelines and best practices for implementing effective logging in a Spring Boot application. 🌟🌟🌟

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1. Importance of Logging

Logging is essential for:

- **Debugging and Troubleshooting**: Helps trace and diagnose issues in the application.
- **Monitoring**: Provides insights into application behavior and performance.
- **Auditing**: Records actions and events for compliance and security. 🛠️🛠️🛠️

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2. Setting Up Logging in Spring Boot

2.1 Default Logging Framework

Spring Boot uses **Logback** as the default logging framework. It supports SLF4J, which is a simple facade for various logging frameworks. 📋📋📋

2.2 Dependency Configuration

Add the following dependency for Logback:

```xml
<dependency>
    <groupId>org.springframework.boot</groupId>
    <artifactId>spring-boot-starter-logging</artifactId>
</dependency>
```

This dependency is included by default in `spring-boot-starter`.

2.3 Logback Configuration File

Spring Boot supports Logback configurations through an XML file `logback-spring.xml` or `logback.xml` placed in the `src/main/resources` directory. 🗃️🗃️🗃️

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3. Logging Levels

3.1 Standard Log Levels

- TRACE: Fine-grained details for debugging (e.g., method entry/exit logs).
- DEBUG: Debugging information.
- INFO: Informational messages about application events.
- WARN: Potential issues that require attention.
- ERROR: Critical issues that prevent normal operation. ⚠️⚠️⚠️

3.2 Configuring Log Levels

Log levels can be configured in `application.yml` or `application.properties`:

```yaml
logging:
  level:
    root: INFO
    com.example: DEBUG
```

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4. MDC (Mapped Diagnostic Context)

4.1 Adding Contextual Information

MDC is used to inject contextual information (e.g., `requestId`, `userId`) into logs. This helps trace specific requests across services. 🔍🔍🔍

4.2 Using MDC in Spring Boot

Add values to MDC in a filter or interceptor:

```java
import org.slf4j.MDC;

public class MDCFilter extends OncePerRequestFilter {
    @Override
    protected void doFilterInternal(HttpServletRequest
request, HttpServletResponse response, FilterChain
filterChain) throws ServletException, IOException {
        try {
            String requestId = UUID.randomUUID().toString();
            MDC.put("requestId", requestId);
            filterChain.doFilter(request, response);
        } finally {
            MDC.clear();
        }
    }
}
```

In your `logback-spring.xml`, add the `requestId` to the log pattern:

```xml
<pattern>%d{yyyy-MM-dd HH:mm:ss} [%thread] %X{requestId}
%-5level %logger{36} - %msg%n</pattern>
```

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5. Best Practices for Logging

5.1 Log Format

Use a consistent and readable log format. Include:

- Timestamp
- Log level
- Thread name
- Contextual information (e.g., `requestId`)
- Message 🕒🕒🕒

5.2 Avoid Sensitive Data

Do not log sensitive information, such as passwords, credit card numbers, or personally identifiable information (PII). 🔒🔒🔒

5.3 Use Appropriate Log Levels

Log messages should be concise and at the appropriate level:

- Use `DEBUG` for development.
- Use `INFO` for general application flow.
- Use `WARN` and `ERROR` for issues and exceptions. ✅✅✅

5.4 Avoid Excessive Logging

Logging too much can:

- Impact application performance.
- Make it difficult to identify critical logs. 🛑🛑🛑

5.5 Centralized Logging

Use tools like ELK Stack (Elasticsearch, Logstash, Kibana) or Splunk to collect, process, and analyze logs across distributed systems. 📊📊📊

5.6 Enable File Rolling

To manage log file size and disk space, configure rolling policies in Logback:

```
<rollingPolicy
class="ch.qos.logback.core.rolling.SizeAndTimeBasedRollingPoli
cy">
    <fileNamePattern>${LOG_FILE}.%d{yyyy-MM-
dd}.%i.zip</fileNamePattern>
```

```
    <maxFileSize>10MB</maxFileSize>
    <maxHistory>30</maxHistory>
</rollingPolicy>
```

5.7 Exception Logging

Always log exceptions with a stack trace to make debugging easier:

```
try {
    // some code
} catch (Exception e) {
    logger.error("An error occurred", e);
}
```

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6. Advanced Techniques

6.1 Async Logging

Improve application performance by enabling asynchronous logging. However, note that asynchronous logging might introduce slight delays in log writing. It may not be ideal in situations requiring immediate log visibility, such as debugging critical issues in real time or environments where logs are relied upon for high-frequency monitoring. 🚀🚀🚀

```
<appender name="ASYNC"
class="ch.qos.logback.classic.AsyncAppender">
    <appender-ref ref="FILE" />
</appender>
```

6.2 Conditional Logging

Enable or disable logging based on properties or environments:

```
<if
condition="property('spring.profiles.active').equals('prod')">
    <then>
        <logger name="com.example" level="INFO" />
    </then>
</if>
```

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7. Monitoring and Alerting

Set up monitoring and alerting for critical logs using tools like:

- ELK Stack: Centralize logs and create dashboards.
- Prometheus/Grafana: Monitor log-based metrics.
- New Relic: Monitor application logs and performance. 📈 📈 📈

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8. Example Logback Configuration

```
<configuration>
    <include resource="org/springframework/boot/logging/logback/defaults.xml" />
    <include resource="org/springframework/boot/logging/logback/console-appender.xml" />

    <appender name="RollingFile" class="ch.qos.logback.core.rolling.RollingFileAppender">
        <encoder class="ch.qos.logback.classic.encoder.PatternLayoutEncoder">
            <pattern>%d{yyyy-MM-dd HH:mm:ss} [%thread] %X{requestId} %-5level %logger{36} - %msg%n</pattern>
        </encoder>
        <rollingPolicy class="ch.qos.logback.core.rolling.SizeAndTimeBasedRollingPolicy">
            <fileNamePattern>${LOG_FILE}.%d{yyyy-MM-dd}.%i.zip</fileNamePattern>
            <maxFileSize>10MB</maxFileSize>
            <maxHistory>30</maxHistory>
        </rollingPolicy>
    </appender>

    <root level="INFO">
        <appender-ref ref="CONSOLE" />
        <appender-ref ref="RollingFile" />
    </root>
</configuration>
```

9. Explanation of Logback Tags

Here is a brief explanation of Logback tags:

- configuration: The root element of the Logback configuration file.
- appender: Defines a specific logging destination, such as a file or console.
- encoder: Specifies the format of log messages.
- rollingPolicy: Configures policies for rolling log files based on size, time, or other conditions.
- logger: Defines log levels for specific packages or classes.
- root: Sets the logging configuration for all loggers if no specific logger is defined.
- pattern: Specifies the layout of the log messages, including timestamp, log level, and custom context.

Thats all for this article see you on the next one🚀🚀🚀