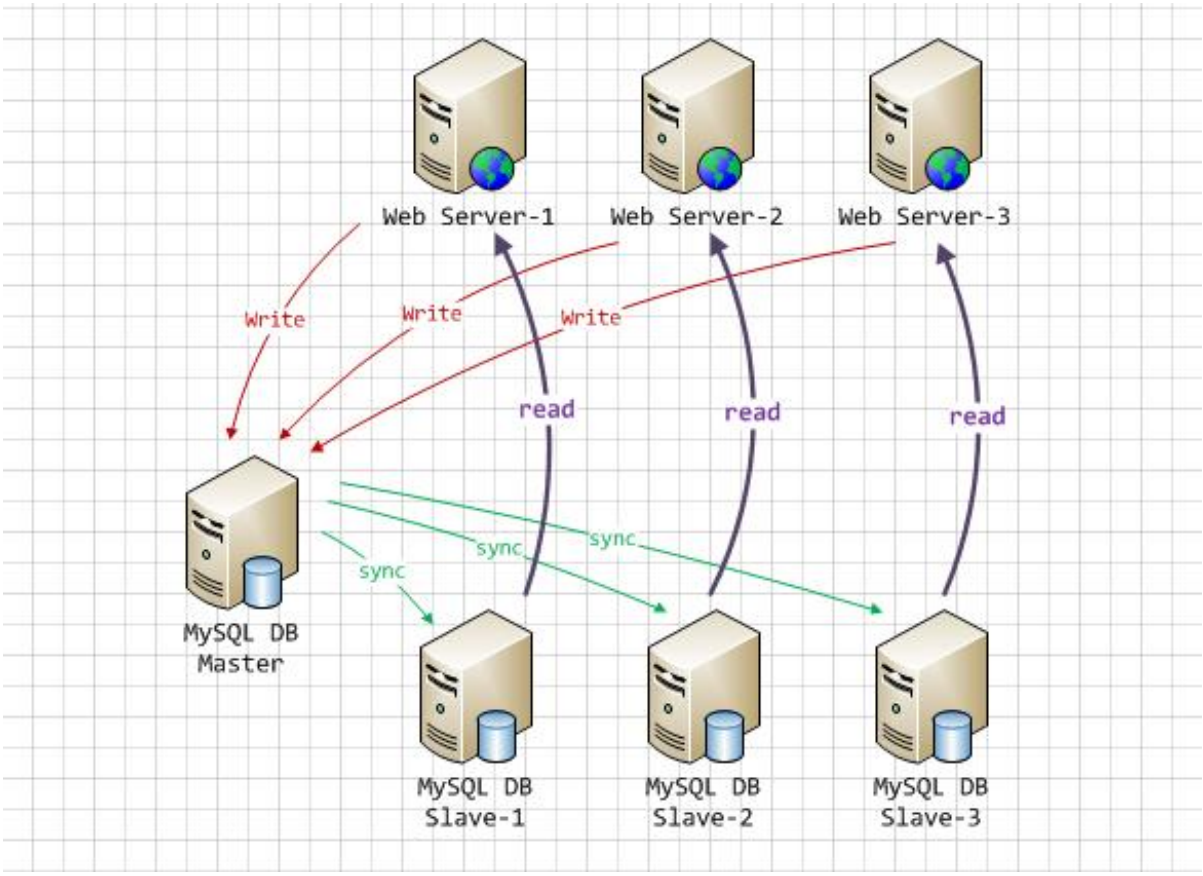
SpringBoot+MyBatis+MySQL读写分离

cnblogs.com/cjsblog/p/9712457.html

1. 引言

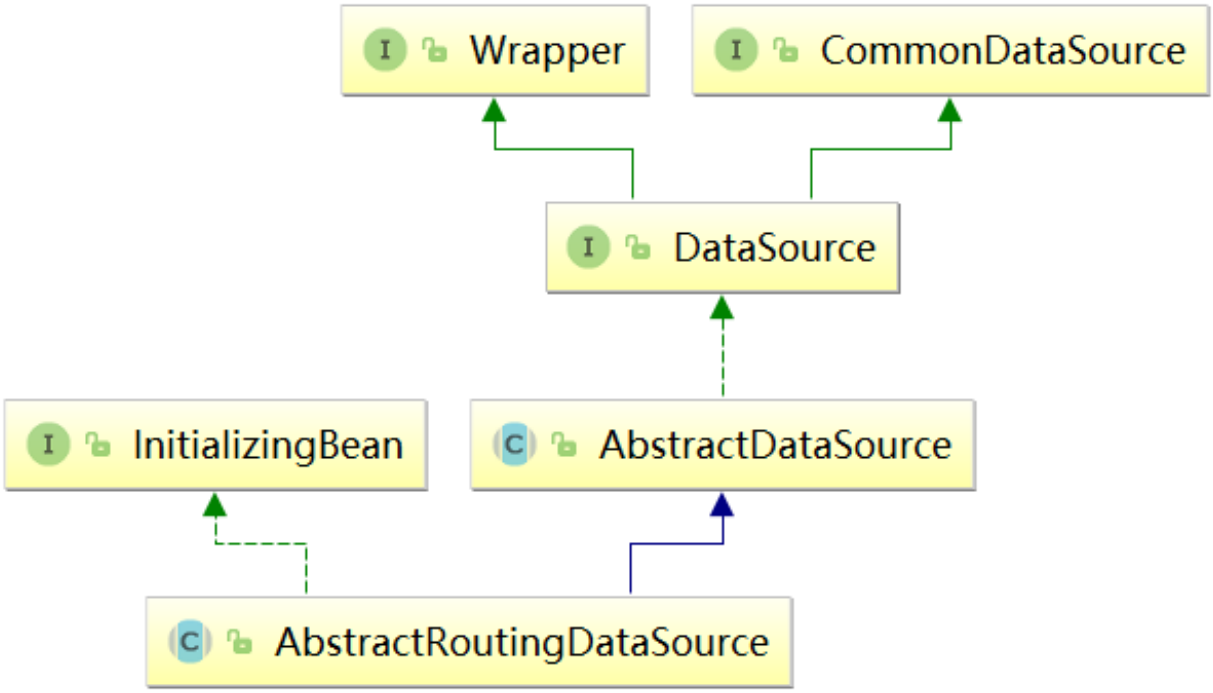
读写分离要做的事情就是对于一条SQL该选择哪个数据库去执行，至于谁来做选择数据库这件事儿，无非两个，要么中间件帮我们做，要么程序自己做。因此，一般来讲，读写分离有两种实现方式。第一种是依靠中间件（比如：MyCat），也就是说应用程序连接到中间件，中间件帮我们做SQL分离；第二种是应用程序自己去做分离。这里我们选择程序自己来做，主要是利用Spring提供的路由数据源，以及AOP

然而，应用程序层面去做读写分离最大的弱点（不足之处）在于无法动态增加数据库节点，因为数据源配置都是写在配置中的，新增数据库意味着新加一个数据源，必然改配置，并重启应用。当然，好处就是相对简单。



2. AbstractRoutingDataSource

基于特定的查找key路由到特定的数据源。它内部维护了一组目标数据源，并且做了路由key与目标数据源之间的映射，提供基于key查找数据源的方法。



3. 实践

关于配置请参考《MySQL主从复制配置》

3.1. maven依赖

```
<?xml version="1.0" encoding="UTF-8"?>
<project xmlns="http://maven.apache.org/POM/4.0.0"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apache.org/xsd/maven-
4.0.0.xsd">
    <modelVersion>4.0.0</modelVersion>

    <groupId>com.cjs.example</groupId>
    <artifactId>cjs-datasource-demo</artifactId>
    <version>0.0.1-SNAPSHOT</version>
    <packaging>jar</packaging>

    <name>cjs-datasource-demo</name>
    <description></description>

    <parent>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter-parent</artifactId>
        <version>2.0.5.RELEASE</version>
        <relativePath/> <!-- lookup parent from repository -->
    </parent>

    <properties>
        <project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>
        <project.reporting.outputEncoding>UTF-8</project.reporting.outputEncoding>
```

```
    <java.version>1.8</java.version>
</properties>

<dependencies>
    <dependency>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter-aop</artifactId>
    </dependency>
    <dependency>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter-jdbc</artifactId>
    </dependency>
    <dependency>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter-web</artifactId>
    </dependency>
    <dependency>
        <groupId>org.mybatis.spring.boot</groupId>
        <artifactId>mybatis-spring-boot-starter</artifactId>
        <version>1.3.2</version>
    </dependency>
    <dependency>
        <groupId>org.apache.commons</groupId>
        <artifactId>commons-lang3</artifactId>
        <version>3.8</version>
    </dependency>

    <dependency>
        <groupId>mysql</groupId>
        <artifactId>mysql-connector-java</artifactId>
        <scope>runtime</scope>
    </dependency>
    <dependency>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter-test</artifactId>
        <scope>test</scope>
    </dependency>
</dependencies>

<build>
    <plugins>
        <plugin>
            <groupId>org.springframework.boot</groupId>
            <artifactId>spring-boot-maven-plugin</artifactId>
        </plugin>


        <!--<plugin>
            <groupId>org.mybatis.generator</groupId>
            <artifactId>mybatis-generator-maven-plugin</artifactId>
            <version>1.3.5</version>
            <dependencies>
                <dependency>
                    <groupId>mysql</groupId>
```

```
                <artifactId>mysql-connector-java</artifactId>
                <version>5.1.46</version>
            </dependency>
        </dependencies>
        <configuration>

<configurationFile>${basedir}/src/main/resources/myBatisGeneratorConfig.xml</configurationFile>
            <overwrite>true</overwrite>
        </configuration>
        <executions>
            <execution>
                <id>Generate MyBatis Artifacts</id>
                <goals>
                    <goal>generate</goal>
                </goals>
            </execution>
        </executions>
      </plugin>-->

    </plugins>
  </build>
</project>
```

3.2. 数据源配置

application.yml

```
spring:
  datasource:
    master:
      jdbc-url: jdbc:mysql://192.168.102.31:3306/test
      username: root
      password: 123456
      driver-class-name: com.mysql.jdbc.Driver
    slave1:
      jdbc-url: jdbc:mysql://192.168.102.56:3306/test
      username: pig   # 只读账户
      password: 123456
      driver-class-name: com.mysql.jdbc.Driver
    slave2:
      jdbc-url: jdbc:mysql://192.168.102.36:3306/test
      username: pig   # 只读账户
      password: 123456
      driver-class-name: com.mysql.jdbc.Driver
```

多数据源配置

```
package com.cjs.example.config;
```

```
import com.cjs.example.bean.MyRoutingDataSource;
import com.cjs.example.enums.DBTypeEnum;
import org.springframework.beans.factory.annotation.Qualifier;
import org.springframework.boot.context.properties.ConfigurationProperties;
import org.springframework.boot.jdbc.DataSourceBuilder;
import org.springframework.context.annotation.Bean;
import org.springframework.context.annotation.Configuration;

import javax.sql.DataSource;
import java.util.HashMap;
import java.util.Map;

/**
 * 关于数据源配置，参考SpringBoot官方文档第79章《Data Access》
 * 79. Data Access
 * 79.1 Configure a Custom DataSource
 * 79.2 Configure Two DataSources
 */

@Configuration
public class DataSourceConfig {

    @Bean
    @ConfigurationProperties("spring.datasource.master")
    public DataSource masterDataSource() {
        return DataSourceBuilder.create().build();
    }

    @Bean
    @ConfigurationProperties("spring.datasource.slave1")
    public DataSource slave1DataSource() {
        return DataSourceBuilder.create().build();
    }

    @Bean
    @ConfigurationProperties("spring.datasource.slave2")
    public DataSource slave2DataSource() {
        return DataSourceBuilder.create().build();
    }

    @Bean
    public DataSource myRoutingDataSource(@Qualifier("masterDataSource") DataSource
masterDataSource,
                                          @Qualifier("slave1DataSource") DataSource slave1DataSource,
                                          @Qualifier("slave2DataSource") DataSource slave2DataSource) {
        Map<Object, Object> targetDataSources = new HashMap<>();
        targetDataSources.put(DBTypeEnum.MASTER, masterDataSource);
        targetDataSources.put(DBTypeEnum.SLAVE1, slave1DataSource);
        targetDataSources.put(DBTypeEnum.SLAVE2, slave2DataSource);
        MyRoutingDataSource myRoutingDataSource = new MyRoutingDataSource();
        myRoutingDataSource.setDefaultTargetDataSource(masterDataSource);
        myRoutingDataSource.setTargetDataSources(targetDataSources);
        return myRoutingDataSource;
```

```
    }

}
```

这里，我们配置了4个数据源，1个master，2两个slave，1个路由数据源。前3个数据源都是为了生成第4个数据源，而且后续我们只用这最后一个路由数据源。

MyBatis配置

```
package com.cjs.example.config;

import org.apache.ibatis.session.SqlSessionFactory;
import org.mybatis.spring.SqlSessionFactoryBean;
import org.springframework.context.annotation.Bean;
import org.springframework.context.annotation.Configuration;
import org.springframework.core.io.support.PathMatchingResourcePatternResolver;
import org.springframework.jdbc.datasource.DataSourceTransactionManager;
import org.springframework.transaction.PlatformTransactionManager;
import org.springframework.transaction.annotation.EnableTransactionManagement;

import javax.annotation.Resource;
import javax.sql.DataSource;

@EnableTransactionManagement
@Configuration
public class MyBatisConfig {

    @Resource(name = "myRoutingDataSource")
    private DataSource myRoutingDataSource;

    @Bean
    public SqlSessionFactory sqlSessionFactory() throws Exception {
        SqlSessionFactoryBean sqlSessionFactoryBean = new SqlSessionFactoryBean();
        sqlSessionFactoryBean.setDataSource(myRoutingDataSource);
        sqlSessionFactoryBean.setMapperLocations(new
PathMatchingResourcePatternResolver().getResources("classpath:mapper/*.xml"));
        return sqlSessionFactoryBean.getObject();
    }

    @Bean
    public PlatformTransactionManager platformTransactionManager() {
        return new DataSourceTransactionManager(myRoutingDataSource);
    }
}
```

由于Spring容器中现在有4个数据源，所以我们需要为事务管理器和MyBatis手动指定一个明确的数据源。

3.3. 设置路由key / 查找数据源

目标数据源就是那前3个这个我们是知道的，但是使用的时候是如果查找数据源的呢？

首先，我们定义一个枚举来代表这三个数据源

```
package com.cjs.example.enums;

public enum DBTypeEnum {

    MASTER, SLAVE1, SLAVE2;

}
```

接下来，通过ThreadLocal将数据源设置到每个线程上下文中

```
package com.cjs.example.bean;

import com.cjs.example.enums.DBTypeEnum;

import java.util.concurrent.atomic.AtomicInteger;

public class DBContextHolder {

    private static final ThreadLocal<DBTypeEnum> contextHolder = new ThreadLocal<>();

    private static final AtomicInteger counter = new AtomicInteger(-1);

    public static void set(DBTypeEnum dbType) {
        contextHolder.set(dbType);
    }

    public static DBTypeEnum get() {
        return contextHolder.get();
    }

    public static void master() {
        set(DBTypeEnum.MASTER);
        System.out.println("切换到master");
    }

    public static void slave() {
        //  轮询
        int index = counter.getAndIncrement() % 2;
        if (counter.get() > 9999) {
            counter.set(-1);
        }
        if (index == 0) {
            set(DBTypeEnum.SLAVE1);
            System.out.println("切换到slave1");
        }else {
            set(DBTypeEnum.SLAVE2);
            System.out.println("切换到slave2");
        }
    }

}
```

获取路由key

```
package com.cjs.example.bean;

import org.springframework.jdbc.datasource.lookup.AbstractRoutingDataSource;
import org.springframework.lang.Nullable;

public class MyRoutingDataSource extends AbstractRoutingDataSource {
    @Nullable
    @Override
    protected Object determineCurrentLookupKey() {
        return DBContextHolder.get();
    }

}
```

设置路由key

默认情况下，所有的查询都走从库，插入/修改/删除走主库。我们通过方法名来区分操作类型（CRUD）

```
package com.cjs.example.aop;

import com.cjs.example.bean.DBContextHolder;
import org.apache.commons.lang3.StringUtils;
import org.aspectj.lang.JoinPoint;
import org.aspectj.lang.annotation.Aspect;
import org.aspectj.lang.annotation.Before;
import org.aspectj.lang.annotation.Pointcut;
import org.springframework.stereotype.Component;

@Aspect
@Component
public class DataSourceAop {

    @Pointcut("!@annotation(com.cjs.example.annotation.Master) " +
            "&& (execution(* com.cjs.example.service..*.select*(..)) " +
            "|| execution(* com.cjs.example.service..*.get*(..)))")
    public void readPointcut() {

    }

    @Pointcut("@annotation(com.cjs.example.annotation.Master) " +
            "|| execution(* com.cjs.example.service..*.insert*(..)) " +
            "|| execution(* com.cjs.example.service..*.add*(..)) " +
            "|| execution(* com.cjs.example.service..*.update*(..)) " +
            "|| execution(* com.cjs.example.service..*.edit*(..)) " +
            "|| execution(* com.cjs.example.service..*.delete*(..)) " +
            "|| execution(* com.cjs.example.service..*.remove*(..))")
    public void writePointcut() {

    }
```

```
    @Before("readPointcut()")
    public void read() {
        DBContextHolder.slave();
    }

    @Before("writePointcut()")
    public void write() {
        DBContextHolder.master();
    }


    /**
     * 另一种写法：if...else...  判断哪些需要读从数据库，其余的走主数据库
     */
//    @Before("execution(* com.cjs.example.service.impl.*.*(..))")
//    public void before(JoinPoint jp) {
//        String methodName = jp.getSignature().getName();
//
//        if (StringUtils.startsWithAny(methodName, "get", "select", "find")) {
//            DBContextHolder.slave();
//        }else {
//            DBContextHolder.master();
//        }
//    }
}
```

有一般情况就有特殊情况，特殊情况是某些情况下我们需要强制读主库，针对这种情况，我们定义一个主键，用该注解标注的就读主库

```
package com.cjs.example.annotation;

public @interface Master {
}
```

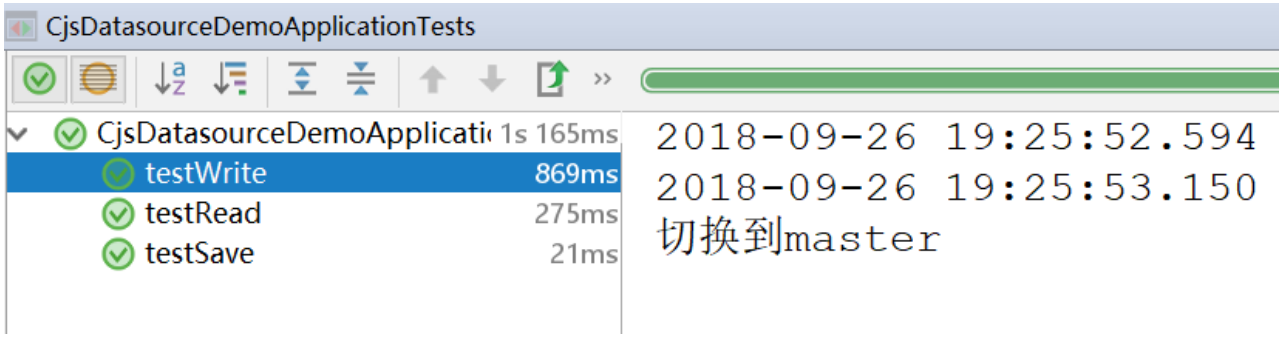
例如，假设我们有一张表member

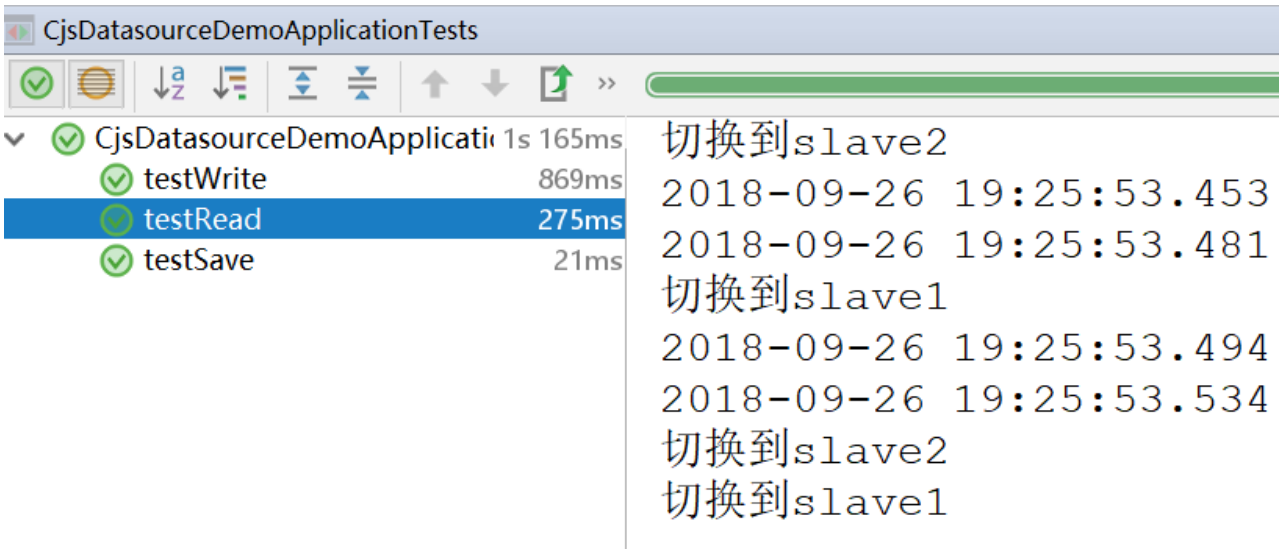
```
package com.cjs.example.service.impl;

import com.cjs.example.annotation.Master;
import com.cjs.example.entity.Member;
import com.cjs.example.entity.MemberExample;
import com.cjs.example.mapper.MemberMapper;
import com.cjs.example.service.MemberService;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.stereotype.Service;
import org.springframework.transaction.annotation.Transactional;

import java.util.List;

@Service
public class MemberServiceImpl implements MemberService {

    @Autowired
    private MemberMapper memberMapper;

    @Transactional
    @Override
    public int insert(Member member) {
        return memberMapper.insert(member);
    }

    @Master
    @Override
    public int save(Member member) {
        return memberMapper.insert(member);
    }

    @Override
    public List<Member> selectAll() {
        return memberMapper.selectByExample(new MemberExample());
    }

    @Master
    @Override
    public String getToken(String appId) {
        // 有些读操作必须读主数据库
        // 比如，获取微信access_token，因为高峰时期主从同步可能延迟
        // 这种情况下就必须强制从主数据读
        return null;
    }
}
```

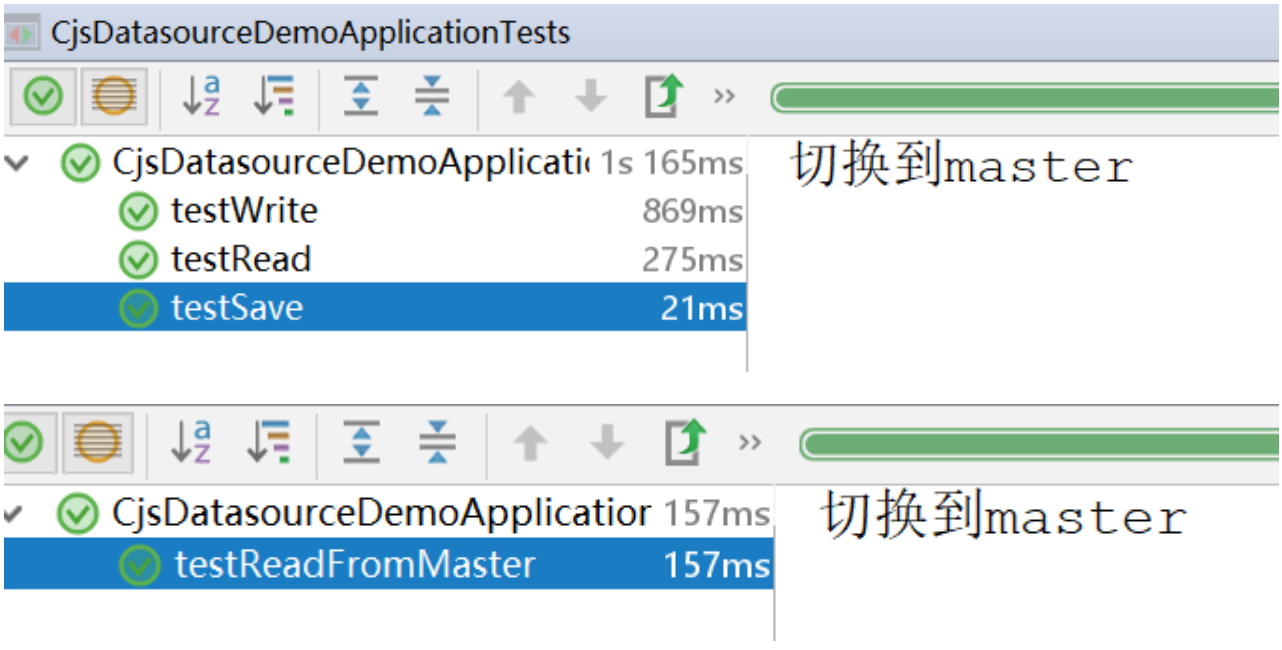
4. 测试

```
package com.cjs.example;

import com.cjs.example.entity.Member;
import com.cjs.example.service.MemberService;
import org.junit.Test;
import org.junit.runner.RunWith;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.boot.test.context.SpringBootTest;
import org.springframework.test.context.junit4.SpringRunner;

@RunWith(SpringRunner.class)
@SpringBootTest
public class CjsDatasourceDemoApplicationTests {

    @Autowired
    private MemberService memberService;

    @Test
    public void testWrite() {
        Member member = new Member();
        member.setName("zhangsan");
        memberService.insert(member);
    }

    @Test
    public void testRead() {
        for (int i = 0; i < 4; i++) {
            memberService.selectAll();
        }
    }

    @Test
    public void testSave() {
        Member member = new Member();
        member.setName("wangwu");
        memberService.save(member);
    }

    @Test
    public void testReadFromMaster() {
        memberService.getToken("1234");
    }

}
```

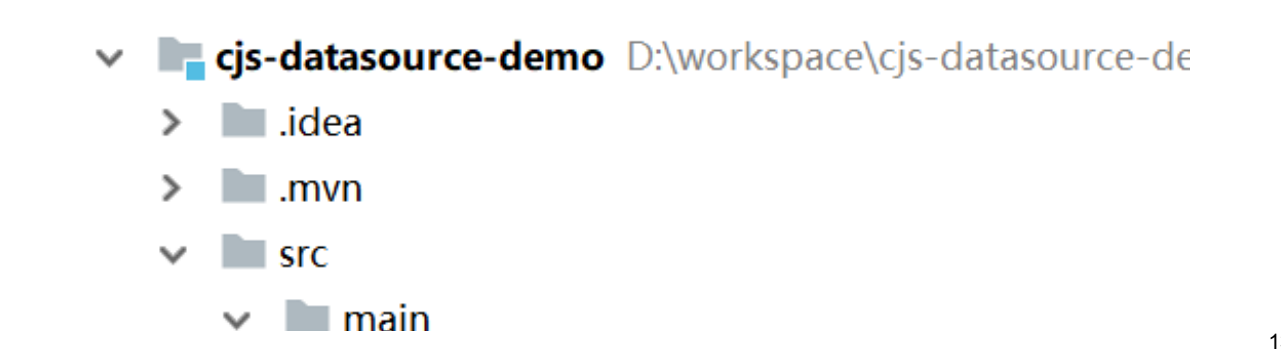
查看控制台

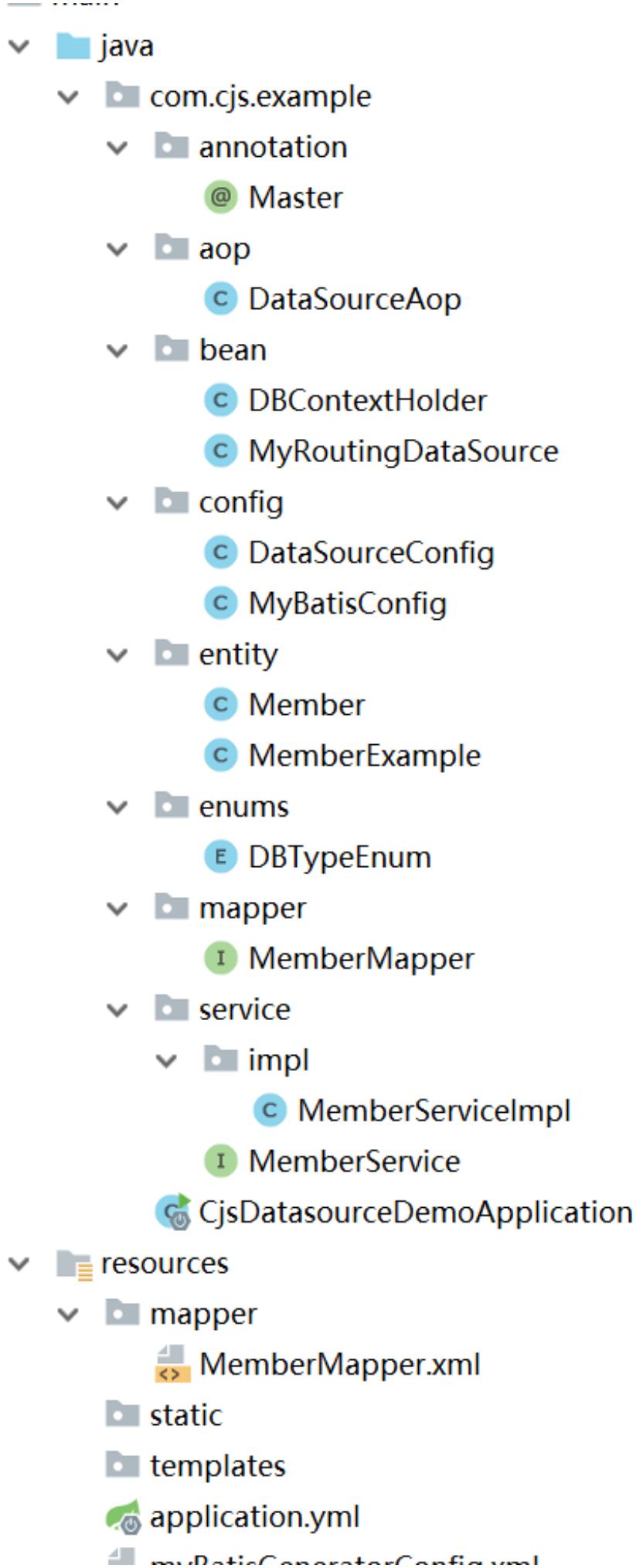

CjsDatasourceDemoApplicationTests
CjsDatasourceDemoApplicati 1s 165ms
testWrite 869ms
testRead 275ms
testSave 21ms
2018-09-26 19:25:52.594
2018-09-26 19:25:53.150
切换到master

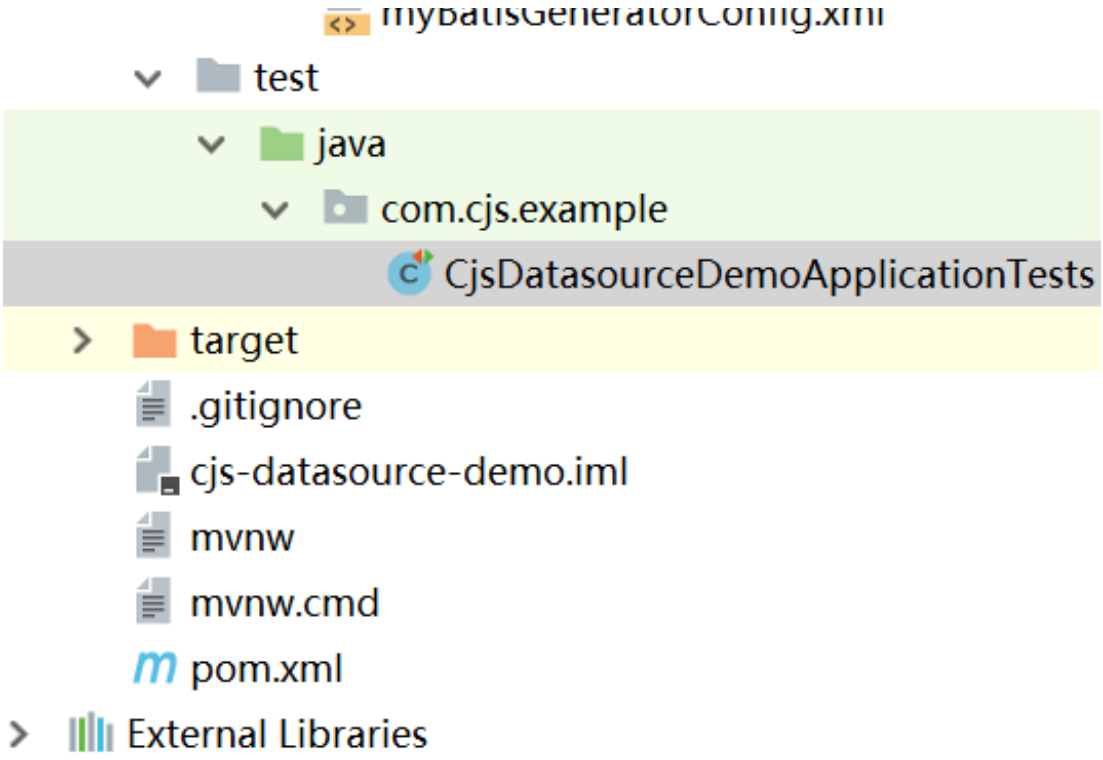

CjsDatasourceDemoApplicationTests
CjsDatasourceDemoApplicati 1s 165ms
testWrite 869ms
testRead 275ms
testSave 21ms
切换到slave2
2018-09-26 19:25:53.453
2018-09-26 19:25:53.481
切换到slave1
2018-09-26 19:25:53.494
2018-09-26 19:25:53.534
切换到slave2
切换到slave1


CjsDatasourceDemoApplicationTests
CjsDatasourceDemoApplicati 1s 165ms
testWrite 869ms
testRead 275ms
testSave 21ms
切换到master
CjsDatasourceDemoApplicatior 157ms
testReadFromMaster 157ms
切换到master

5. 工程结构


cjs-datasource-demo D:\workspace\cjs-datasource-de
.idea
.mvn
src
main


java
com.cjs.example
annotation
Master
aop
DataSourceAop
bean
DBContextHolder
MyRoutingDataSource
config
DataSourceConfig
MyBatisConfig
entity
Member
MemberExample
enums
DBTypeEnum
mapper
MemberMapper
service
impl
MemberServiceImpl
MemberService
CjsDatasourceDemoApplication
resources
mapper
MemberMapper.xml
static
templates
application.yml



6. 参考

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https://www.jianshu.com/p/f2f4256a2310

http://www.cnblogs.com/gl-developer/p/6170423.html

https://www.cnblogs.com/huangjuncong/p/8576935.html

https://blog.csdn.net/liu976180578/article/details/77684583