SpringOne Platform by Pivotal

JDBC, what is it good for?

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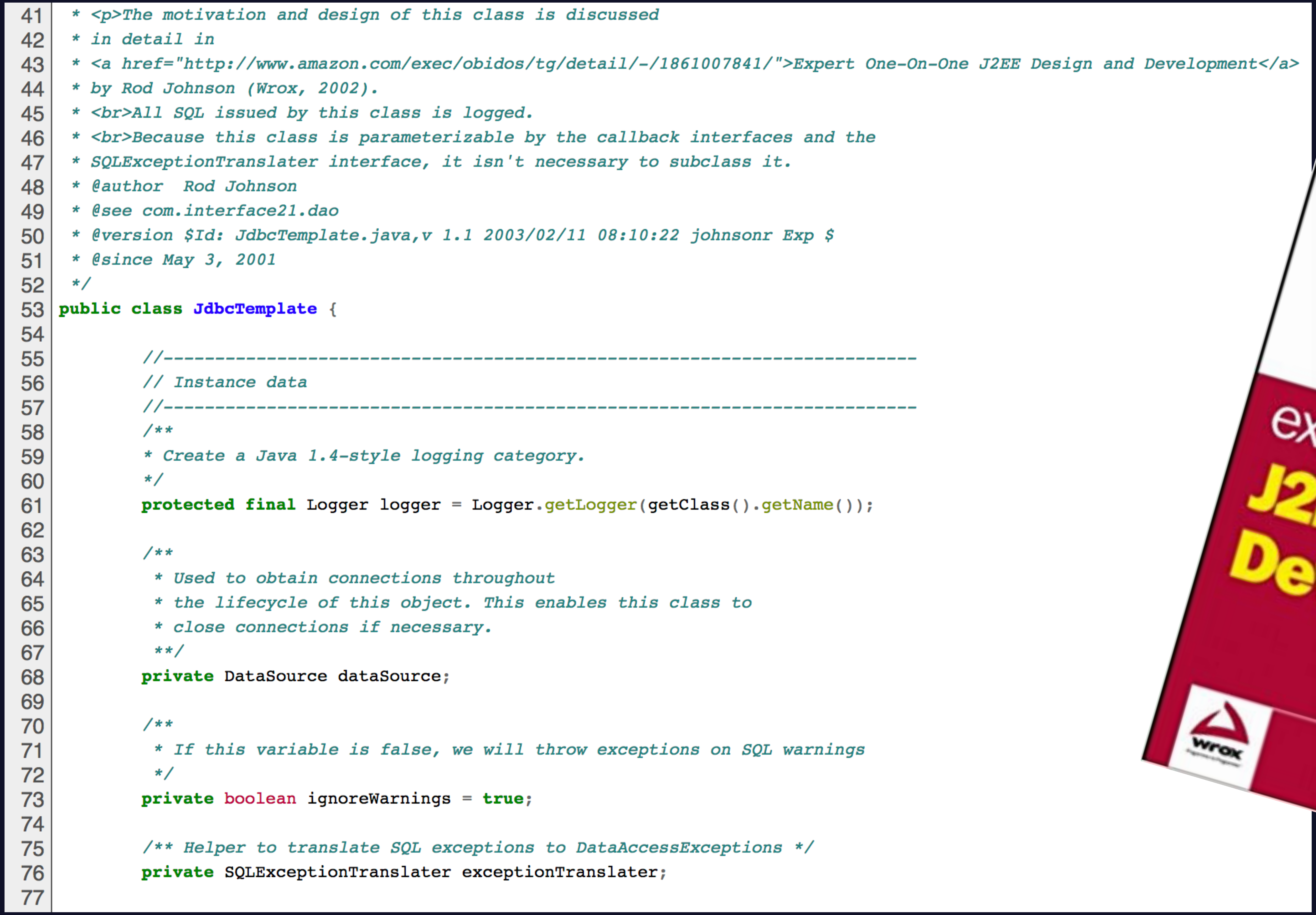
About Me

Thomas Risberg (@trisberg)

- Member of the Spring engineering team at Pivotal
- Contributing to Project riff and Spring Cloud Data Flow
- Joined the Spring Framework open source project in 2003 working on JDBC support

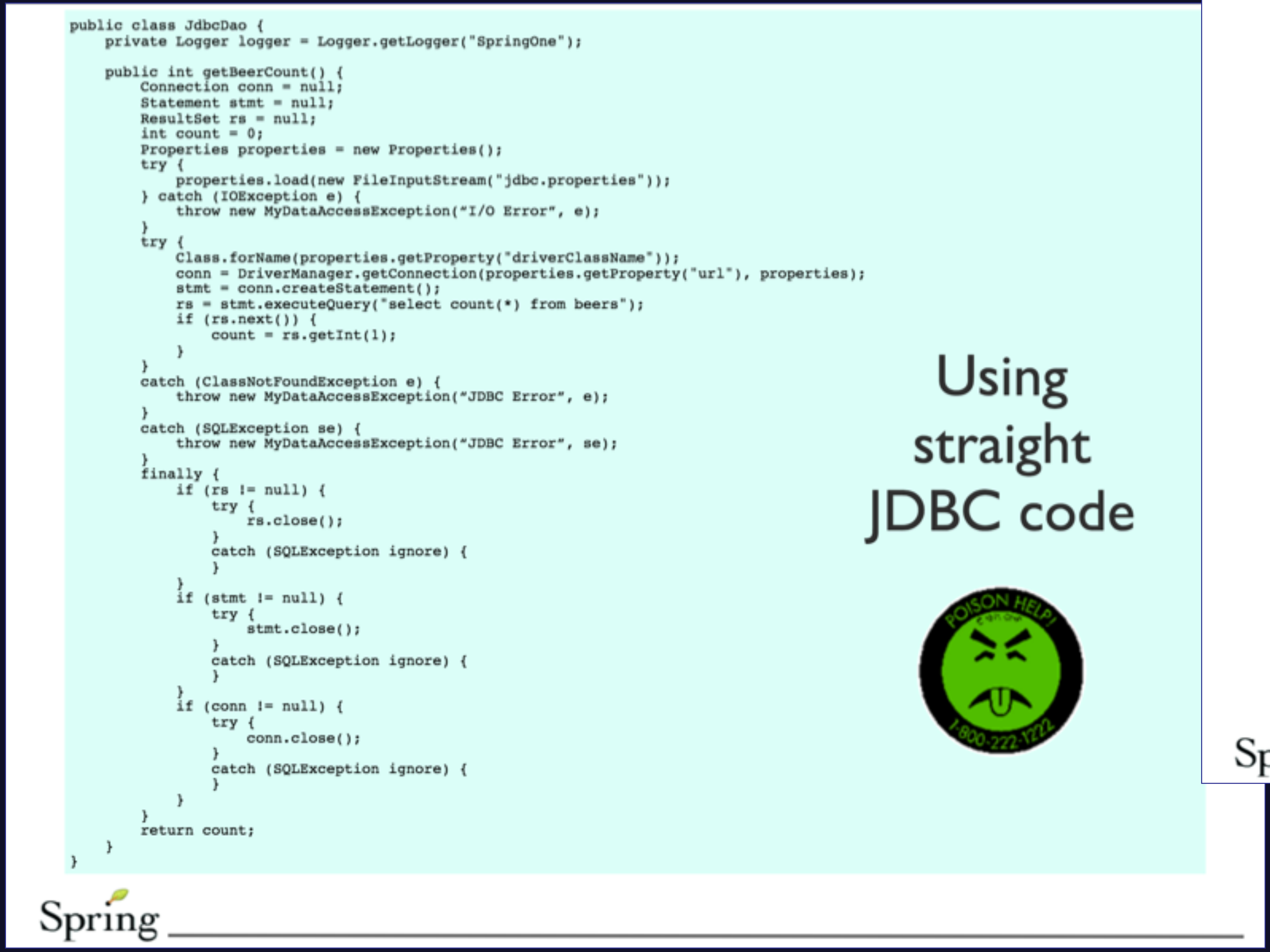
Where it all started … back in 2002



```
 * <p>The motivation and design of this class is discussed
 * in detail in
 * <a href="http://www.amazon.com/exec/obidos/tg/detail/-/1861007841/">Expert One-On-One J2EE Design and Development</a>
 * by Rod Johnson (Wrox, 2002).
 * <br>All SQL issued by this class is logged.
 * <br>Because this class is parameterizable by the callback interfaces and the
 * SQLExceptionTranslater interface, it isn't necessary to subclass it.
 * @author  Rod Johnson
 * @see com.interface21.dao
 * @version $Id: JdbcTemplate.java,v 1.1 2003/02/11 08:10:22 johnsonr Exp $
 * @since May 3, 2001
 */
public class JdbcTemplate {

        //---------------------------------------------------------------------
        // Instance data
        //---------------------------------------------------------------------
        /**
        * Create a Java 1.4-style logging category.
        */
        protected final Logger logger = Logger.getLogger(getClass().getName());

        /**
         * Used to obtain connections throughout
         * the lifecycle of this object. This enables this class to
         * close connections if necessary.
         **/
        private DataSource dataSource;

        /**
         * If this variable is false, we will throw exceptions on SQL warnings
         */
        private boolean ignoreWarnings = true;

        /** Helper to translate SQL exceptions to DataAccessExceptions */
        private SQLExceptionTranslater exceptionTranslater;

```

Programmer to Programmer
Rod Johnson
Rod Johnson is an enterprise Java architect specializing in scalable web applications. He has worked with both Java and J2EE since their release, and he is a member of JSR 154 Expert Group defining the Servlet 2.4 specification.
expert one-on-one
J2EE™ Design and Development
Wrox
Updates, source code, and Wrox technical support at www.wrox.com

Spring solved JDBC try-catch nightmare and more

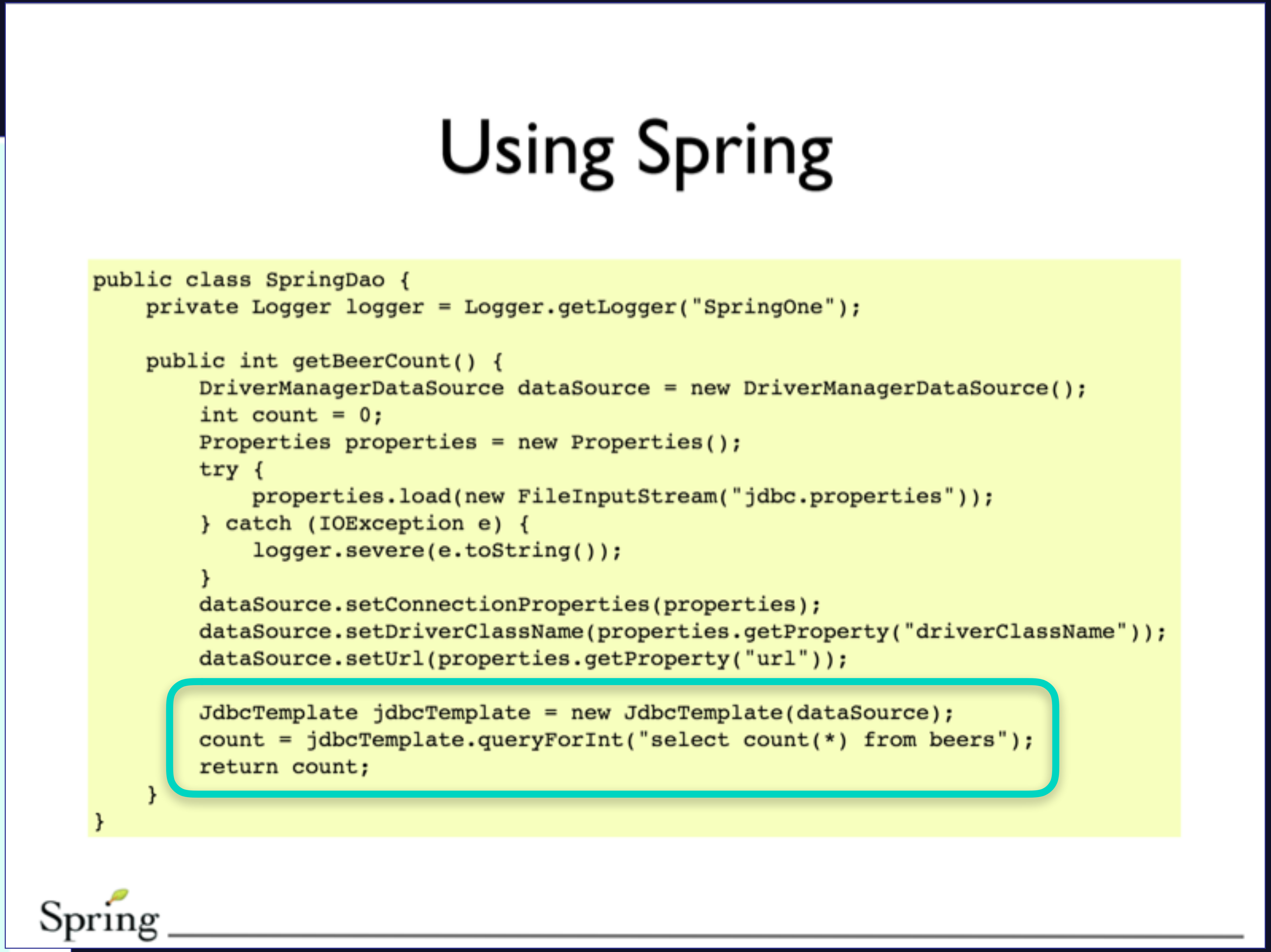


```java
public class JdbcDao {
    private Logger logger = Logger.getLogger("SpringOne");

    public int getBeerCount() {
        Connection conn = null;
        Statement stmt = null;
        ResultSet rs = null;
        int count = 0;
        Properties properties = new Properties();
        try {
            properties.load(new FileInputStream("jdbc.properties"));
        } catch (IOException e) {
            throw new MyDataAccessException("I/O Error", e);
        }
        try {
            Class.forName(properties.getProperty("driverClassName"));
            conn = DriverManager.getConnection(properties.getProperty("url"), properties);
            stmt = conn.createStatement();
            rs = stmt.executeQuery("select count(*) from beers");
            if (rs.next()) {
                count = rs.getInt(1);
            }
        }
        catch (ClassNotFoundException e) {
            throw new MyDataAccessException("JDBC Error", e);
        }
        catch (SQLException se) {
            throw new MyDataAccessException("JDBC Error", se);
        }
        finally {
            if (rs != null) {
                try {
                    rs.close();
                }
                catch (SQLException ignore) {
                }
            }
            if (stmt != null) {
                try {
                    stmt.close();
                }
                catch (SQLException ignore) {
                }
            }
            if (conn != null) {
                try {
                    conn.close();
                }
                catch (SQLException ignore) {
                }
            }
        }
        return count;
    }
}
```

Using straight JDBC code

POISON HELP!
1-800-222-1222

Spring



Using Spring

```java
public class SpringDao {
    private Logger logger = Logger.getLogger("SpringOne");

    public int getBeerCount() {
        DriverManagerDataSource dataSource = new DriverManagerDataSource();
        int count = 0;
        Properties properties = new Properties();
        try {
            properties.load(new FileInputStream("jdbc.properties"));
        } catch (IOException e) {
            logger.severe(e.toString());
        }
        dataSource.setConnectionProperties(properties);
        dataSource.setDriverClassName(properties.getProperty("driverClassName"));
        dataSource.setUrl(properties.getProperty("url"));

        JdbcTemplate jdbcTemplate = new JdbcTemplate(dataSource);
        count = jdbcTemplate.queryForInt("select count(*) from beers");
        return count;
    }
}
```

Spring

From "Spring JDBC" presentation at OSCON 2005
https://github.com/trisberg/s1p2017-jdbc/tree/master/older-presentations

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Spring JDBC - who does what?

	Spring	You
DataSource/Connection Configuration		✓
Connection Management	✓	
Specify the SQL statement and its parameters		✓
Manage statement execution and loop through results	✓	
Retrieve and handle data for each row		✓
Manage the transaction	✓	
Translate exceptions to RuntimeExceptions	✓	

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Spring JDBC Support

Choosing an approach for JDBC database access

- **JdbcTemplate** is the classic Spring JDBC approach and the most popular
- **NamedParameterJdbcTemplate** wraps a **JdbcTemplate** to provide named parameters instead of the traditional JDBC "?" placeholders
- **SimpleJdbcInsert** and **SimpleJdbcCall** utilize database metadata to limit the amount of necessary configuration
- RDBMS Objects including **MappingSqlQuery**, **SqlUpdate** and **StoredProcedure** for creating reusable and thread-safe objects during initialization

Demo

Some JDBC Examples

https://github.com/trisberg/s1p2017-jdbc/tree/master/jdbc-demo

What is next for Spring JDBC?

A new **Spring Data JDBC** project

https://github.com/spring-projects/spring-data-jdbc

- Spring Data Repository implementation with JDBC
  - **This is NOT an ORM**
- CRUD operations
- Id generation
- NamingStrategy
- Events
  - BeforeDelete / AfterDelete
  - BeforeSave / AfterSave
  - AfterCreation

Demo

Spring Data JDBC Demo App

https://github.com/gregturn/spring-data-jdbc-demo

Using JDBC in new application architectures

- Microservices / Cloud Deployments
- Event Sourcing / CQRS
- Reactive, Non-Blocking APIs
- Serverless

JDBC in the Cloud

Connecting to RDBMS databases in cloud environments

- Cloud Foundry
- Kubernetes

Cloud Foundry for Spring Boot with JDBC

Running Spring Boot JDBC Apps

- **Java Buildpack** will auto-reconfigure your app injecting its own `DataSource` configuration unless:
  - You have multiple `DataSource` beans defined
  - You have multiple RDBMS services bound to you app
- **Java Buildpack** auto-reconfiguration will also inject a symbolic link to it's jdbc driver if you don't provide one in your app jar
- You can turn auto-reconfiguration off with an environment variable:
  - `JBP_CONFIG_SPRING_AUTO_RECONFIGURATION: '[enabled: false]'`
- You probably still want to set the active profile:
  - `SPRING_PROFILES_ACTIVE: cloud`

Deploying JDBC Spring Boot App on Cloud Foundry

```
cf create-service p-mysql 512mb mysql
cf push -f cloudfoundry/jdbc-demo_manifest.yml \
 -p target/spring-data-jdbc-demo-0.0.1-SNAPSHOT.jar
```

cloudfoundry/jdbc-demo_manifest.yml

```
applications:
- name: jdbc-demo
  disk_quota: 512M
  instances: 1
  memory: 512M
  routes:
  - route: jdbc-demo.local.pcfdev.io
  services:
  - mysql
  stack: cflinuxfs2
```

resources/application-cloud.properties

```
spring.datasource.platform=mysql
spring.datasource.initialization-mode=always
spring.datasource.driverClassName=org.mariadb.jdbc.Driver
```

resources/schema-mysql.sql

```
CREATE TABLE IF NOT EXISTS Employee ( id BIGINT AUTO_INCREMENT
PRIMARY KEY, firstname VARCHAR(100), lastname VARCHAR(100), role
VARCHAR(20))
CREATE TABLE IF NOT EXISTS Manager ( manager_id BIGINT
AUTO_INCREMENT PRIMARY KEY, NAME VARCHAR(100))
```

Deploying JDBC Spring Boot App on Kubernetes

```
kubectl apply -f kubernetes/mysql/
kubectl apply -f kubernetes/
```

kubernetes/jdbc-demo-config.yaml

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: jdbc-demo
  labels:
    app: jdbc-demo
data:
  application.yaml: |-
    spring:
      datasource:
        url: jdbc:mysql://${MYSQL_SERVICE_HOST}:${MYSQL_SERVICE_PORT}/mysql
        username: root
        password: ${MYSQL_ROOT_PASSWORD}
        driverClassName: org.mariadb.jdbc.Driver
        testOnBorrow: true
        validationQuery: "SELECT 1"
```

resources/application-kubernetes.properties

```
spring.datasource.platform=mysql
spring.datasource.initialization-mode=always
spring.datasource.driverClassName=org.mariadb.jdbc.Driver
```

resources/schema-mysql.sql

```
CREATE TABLE IF NOT EXISTS Employee ( id BIGINT AUTO_INCREMENT
PRIMARY KEY, firstname VARCHAR(100), lastname VARCHAR(100), role
VARCHAR(20))
CREATE TABLE IF NOT EXISTS Manager ( manager_id BIGINT AUTO_INCREMENT
PRIMARY KEY, NAME VARCHAR(100))
```

Event Sourcing / CQRS

- Separates reads from writes
- Uses different data models for Event Store and Read Storage
- Might use different type of data stores for Event Store and Read Storage
- JDBC could be a good for for one or both of them

JDBC and Async / Reactive

We are not there yet.

Async JDBC proposal from JavaOne 2017

- Developed by the JDBC Expert Group through the Java Community Process
- The API is available for download from OpenJDK at
  http://oracle.com/goto/java-async-db
- Send feedback to jdbc-spec-discuss@openjdk.java.net

Fake it using thread pools, an async layer and Futures to hide your blocking calls

Serverless JDBC

Running serverless functions accessing RDBMS data

- Spring Cloud Function provides abstraction layer that can be used on:
  - Project riff ✓
  - AWS Lambda ✓
  - Azure Functions
  - Open Whisk
  - Fn Project
  - …
- Prefer using JDBC rather than JPA/Hibernate for faster cold start

The JDBC Function

```java
public class JdbcWriter implements Function<Map<String, Object>, String> {

   @Autowired
    private JdbcTemplate jdbcTemplate;

    private SimpleJdbcInsert insert;

    @PostConstruct
    public void init() {
       this.insert = new SimpleJdbcInsert(jdbcTemplate)
                .withTableName("data")
                .usingColumns("name", "description")
                .usingGeneratedKeyColumns("id");
    }

   @Override
    public String apply(Map<String, Object> data) {
        logger.info("Received: " + data);
        Object name = data.get("name");
        Object description = data.get("description");
        logger.info("Inserting into data table: [" + name + ", " + description +"]");
        SqlParameterSource input = new MapSqlParameterSource("name", name).addValue("description", description);
        Number newId = insert.executeAndReturnKey(input);
        logger.info("NewId is: " + newId);
        return "{ \"newId\": " + newId + " }";
    }

}
```

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Spring Cloud Function on AWS Lambda

```yaml
AWSTemplateFormatVersion : '2010-09-09'
Transform: AWS::Serverless-2016-10-31
Description: Spring Cloud Function with JDBC Writer
Parameters:
  DBPwd:
    NoEcho: true
    Description: The database account password
    Type: String
Resources:
  Employee:
    Type: AWS::Serverless::Function
    Properties:
      FunctionName: JdbcWriter
      Handler: org.springframework.cloud.function.adapter.aws.SpringBootStreamHandler
      Runtime: java8
      CodeUri: s3://trisberg-functions/jdbc-writer-0.0.1-SNAPSHOT-uber.jar
      Description: Demo JDBC Writer on AWS
      Timeout: 30
      MemorySize: 1024
      Environment:
        Variables:
          SPRING_DATASOURCE_URL: jdbc:mysql://springone.clsmkylda5na.us-east-1.rds.amazonaws.com:3306/test
          SPRING_DATASOURCE_USERNAME: master
          SPRING_DATASOURCE_PASSWORD: { "Ref" : "DBPwd" }
          SPRING_DATASOURCE_PLATFORM: mysql
      Role: arn:aws:iam::641162161031:role/lambda-execution-role
```

Spring Cloud Function on Project riff

```yaml
apiVersion: projectriff.io/v1
kind: Topic
metadata:
  name: data
---
apiVersion: projectriff.io/v1
kind: Function
metadata:
  name: jdbc-writer
spec:
  protocol: http
  input: data
  container:
    image: trisberg/jdbc-writer:0.0.1-SNAPSHOT
    env:
    - name: FUNCTION_URI
      value: file:///functions/function.jar?handler=example.JdbcWriter
    - name: SPRING_PROFILES_ACTIVE
      value: kubernetes
    - name: SPRING_DATASOURCE_DRIVER_CLASS_NAME
      value: 'org.mariadb.jdbc.Driver'
    - name: SPRING_DATASOURCE_URL
      value: 'jdbc:mysql://data-mysql:3306/mysql'
    - name: SPRING_DATASOURCE_USERNAME
      value: root
    - name: SPRING_DATASOURCE_PASSWORD
      valueFrom:
        secretKeyRef:
          name: data-mysql
          key: mysql-root-password
```

Demo

Spring Cloud Function JDBC Writer App

https://github.com/trisberg/s1p2017-jdbc/tree/master/jdbc-writer

Learn More. Stay Connected.

https://github.com/spring-projects/spring-framework/tree/master/spring-jdbc

https://github.com/spring-projects/spring-data-jdbc

https://github.com/spring-cloud/spring-cloud-function

https://github.com/projectriff/riff

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@s1p #springone