Break New Ground

San Francisco
September 16–19, 2019

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Java/JDBC Scalability and Asynchrony: Reactive Extension and Fibers

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September 18, 2019

Oracle Database JDBC Drivers Available Today on Maven Central

- Oracle Database 19.3 release available now
  https://repo1.maven.org/maven2/com/oracle/ojdbc/
- Future releases including patch sets will be uploaded as released
- Selected older releases will be made available

ADBA Standardization Effort Terminated

- Oracle will not work on ADBA (Asynchronous Database Access)
- No work on the API
- No work on the JDBC reference implementation
- No work on any async database access Java standard
- The API and JDBC implementation are GPL, others can continue if they wish

Loom is the Future of Scalable Java

- The value of async code is scalability
- Sequential code is simpler but wastes resources on threads
- Async code is more complex but saves resources
- Project Loom introduces fibers
- Fibers are lightweight threads. Easily millions per JVM
- https://openjdk.java.net/projects/loom/

Scalable Database Access

- A fiber blocked waiting on a database uses negligible resources
- Fiber code is as scalable as async code but simpler
- Use exactly the same JDBC API we all know and love and get the scalability you need
- Frameworks and libraries must change to take advantage of fibers

Oracle Database JDBC Drivers are Fiber-Ready

- Oracle Database 20c JDBC drivers are fiber-ready
- No API change
- Your Oracle JDBC code using 20c will work with fibers without change

Fiber Demo

Oracle Database 20c JDBC Includes Async Extensions

- Oracle Database 20c JDBC drivers include a small number of proprietary extensions to support async database access
- The implementation uses NIO Selector so no threads block waiting on the database
- Minimal API. Not every use case supported
- No expectation that this wil ever be a Java standard. Fibers are the future for Java

oracle.jdbc.ConnectionBuilder

```
public Publisher<OracleConnection> buildPublisherOracle();
```

- Uses the reactive stream model exposed by java.util.concurrent.Flow
- Call Subscription.request to get a Connection
- Method names suffixed with "Oracle" to avoid name conflicts in the unlikely event this is added to the JDBC standard

oracle.jdbc.OraclePreparedStatement

```
public Publisher<Boolean> executeAsyncOracle();
```

- Async version of PreparedStatement.execute()
- Publisher emits a single Boolean result type.
- Calling thread not blocked
- But any other call to the Connection or its dependents will block while the async operation is in-flight

oracle.jdbc.OraclePreparedStatement

```
public Publisher<Long> executeUpdateAsyncOracle();
```

- Async version of PreparedStatement.executeUpdate()
- Publisher emits a single update count.
- Calling thread not blocked
- But any other call to the Connection or its dependents will block while the async operation is in-flight

oracle.jdbc.OraclePreparedStatement

```
public Publisher<Long> executeBatchAsyncOracle();
```

- Async version of PreparedStatement.executeBatch()
- Publisher emits multiple update counts, one per statement
- Calling thread not blocked
- But any other call to the Connection or its dependents will block while the async operation is in-flight

oracle.jdbc.OraclePreparedStatement

```
public Publisher<OracleResultSet> executeQueryAsyncOracle();
```

- Async version of PreparedStatement.executeQuery()
- Publisher emits a single result set.
- Calling thread not blocked
- But any other call to the Connection or its dependents will block while the async operation is in-flight

oracle.jdbc.OracleResultSet

```
public <T> Publisher<T>
    publisherOracle(Function<OracleRow, T> f);
```

- Publishes the reified rows of the ResultSet
- Function argument f reifies the rows.
  The OracleRow is only valid during the call to f
- publisherOracle closes the ResultSet

oracle.jdbc.OracleResultSet (continued)

```
public <T> Publisher<T>
    publisherOracle(Function<OracleRow, T> f);
```

- OracleRow extends Cloneable so you can copy the row if you want:

```
Publisher<OracleRow> rowPublisher =
    resultSet.publisherOracle(OracleRow::clone);
```


oracle.jdbc.OracleResultSet (continued)

```
public <T> Publisher<T>
    publisherOracle(Function<OracleRow, T> f)
```

- Or construct some other Object, ie an Employee, if appropriate:

```
Publisher<Employee> employeePublisher =
    resultSet.publisherOracle(this::mapRowToEmployee);
```


oracle.jdbc.OracleRow

```
public <T> T getObject(int index, Class<T> type);
public <T> T getObject(String name, Class<T> type);
public OracleRow clone();
```

- Uses the generic getter methods added to JDBC 4.2
- OracleRows passed to the reify method are backed by internal data structures. No copying
- Call clone() if you want to copy or construct another object

oracle.jdbc.OracleConnection

```
public Publisher<Success> closeAsyncOracle();
public Publisher<Success> commitAsyncOracle();
public Publisher<Success> rollbackAsyncOracle();
```

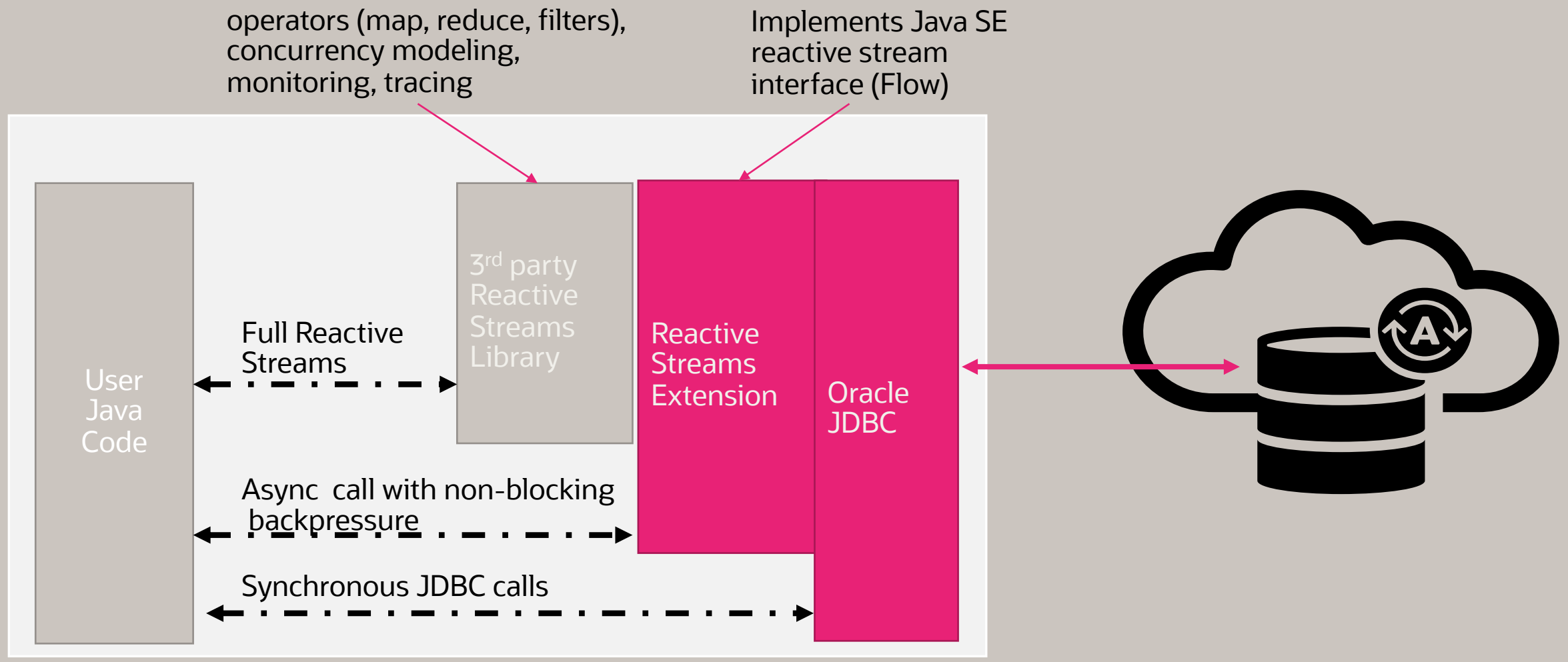
- Async versions of Connection.close(), Connection.commit(), and Connection.rollback()
- Publisher emits a single Success enum.

Notes

- Support for reading and writing BFILE, BLOB, and CLOB
- Only one async operation at a time. Subsequent calls to the Connection or its dependents block except for cancel, isClosed, etc
- This is not ADBA. Cannot queue operations
- 80/20 rule. 80% of the benefit for 20% (or less) of the API
- Compatible with reactive stream libraries that support Flow
- In the long term, fibers are the answer

Async Demo

Database Access with Oracle JDBC



Q & A

What's Ahead

Wednesday

5:00-5:45 Developing and Deploying Oracle Database Applications in Kubernetes

Thursday

9:00-9:45 Microservice Essentials: Kubernetes and Ecosystem, Data, and Transaction Patterns

12:15-1:00 A Database Proxy for Transparent HA, Performance, Routing, and Security

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