

# Implementing a many-to-many Relationship with Slick

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Source code and Slides available at:  
<https://github.com/hermannhueck/MusicService>

# Who am I?

Hermann Hueck

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# Presentation Overview

- Short Intro to Slick
- Many-to-many Relationship with Slick –  
Example: A Music Service
- Q & A

# Part 1: Intro to Slick

- What is Slick?
- What is FRM (Functional Relational Mapping)?
- Why is it reactive?
- Short Reminder of Scala Futures
- Simple Slick Example (Activator Template: hello-slick-3.0)
- Table Definitions without and with Case Class Mapping

# What is Slick?

The Slick manual says:

Slick (“Scala Language-Integrated Connection Kit”) is Typesafe’s Functional Relational Mapping (FRM) library for Scala that makes it easy to work with relational databases. It allows you to work with stored data almost **as if you were using Scala collections** while at the same time giving you full control over when a database access happens and which data is transferred. You can also **use SQL directly**. Execution of database actions is done **asynchronously**, making Slick a perfect fit for your reactive applications based on Play and Akka.

# What is FRM?

- FRM = Functional Relational Mapping (opposed to ORM)
- Slick allows you to process persistent relational data stored in DB tables the same (functional) way as you do with in-memory data, i.e. Scala collections.
- Table Queries are monads.
- Table Queries are pre-optimized.
- Table Queries are type-safe.
- The Scala compiler complains, if you specify your table query incorrectly.

# *TableQuery* s are Monads.

- ***filter()*** for the selection of data
- ***map()*** for the projection
- ***flatMap()*** to pass the output of your 1st DB operation as input to the 2nd DB operation.
- With the provision of these three monadical functions *TableQuery* s are monads.
- Hence you can also use the syntactic sugar of ***for-comprehensions***.
- There is more. E.g. the ***sortBy()*** function allows you to define the sort order of your query result.

# Why is Slick reactive?

- It is **asynchronous** and **non-blocking**.
- It provides its **own** configurable **thread pool**.
- If you run a database action you never get the *Result* directly. You always get a ***Future*****[Result]**.

```
val dbAction: DBIOAction[Seq[String]] = TableQuery(...).result
```

```
val future: Future[Seq[String]] = db.run( dbAction )
```

- Slick supports **Reactive Streams**. Hence it can easily be used together with Akka-Streams.

```
val dbAction: StreamingDBIO[Seq[String]] = TableQuery(...).result
```

```
val publisher: DatabasePublisher[String] = db.stream( dbAction )
```

```
val source: Source = Source.fromPublisher( publisher )
```

```
// Now use the Source to construct a RunnableGraph. Then run the graph.
```



# Short Reminder of Scala Futures

In Slick every database access returns a Future.

How can one async (DB) function process the result of another async (DB) function?

This scenario happens very often when querying and manipulating database records.

# How to process the Result of an Async Function by another Async Function

## Using ***Future.flatMap***:

```
def doAAsync(input: String): Future[A] = Future { val a = f(input); a }  
def doBAsync(a: A): Future[B] = Future { val b = g(a); b }  
  
val input = "some input"  
  
val futureA: Future[A] = doAAsync(input)  
  
val futureB: Future[B] = futureA flatMap { a => doBAsync(a) }  
  
futureB.foreach { b => println(b) }
```

# Async Function processing the Result of another Async Function

Using a **for-comprehension**:

```
def doAAsync(input: String): Future[A] = Future { val a = f(input); a }  
def doBAsync(a: A): Future[B] = Future { val b = g(a); b }  
val input = "some input"  
val futureB: Future[B] = for {  
    a <- doAAsync(input)  
    b <- doBAsync(a)  
} yield b  
futureB.foreach { b => println(b) }
```

# A Simple Slick Example

Activator Template: ***hello-slick-3.1***

# Table Definition with a Tuple

Tuple



```
class Users(tag: Tag) extends Table[(String, Option[Int])](tag, "USERS") {  
  
  // Auto Increment the id primary key column  
  def id = column[Int]("ID", 0.PrimaryKey, 0.AutoInc)  
  
  // The name can't be null  
  def name = column[String]("NAME", 0.NotNull)  
  
  // the * projection (e.g. select * ...)  
  def * = (name, id.?)  
}
```

# Table Definition with Case Class Mapping

```
case class User(name: String, id: Option[Int] = None)
```

```
class Users(tag: Tag) extends Table[User](tag, "USERS") {
```

```
// Auto Increment the id primary key column  
def id = column[Int]("ID", 0.PrimaryKey, 0.AutoInc)
```

```
// The name can't be null  
def name = column[String]("NAME", 0.NotNull)
```

```
// the * projection (e.g. select * ...) auto-transforms the tupled  
// column values to / from a User
```

```
def * = (name, id.?) <> (User.tupled, User.unapply)  
}
```

Map Tuple to User

Map User to Tuple

# Part 2: Many-to-many with Slick

- The Demo App: *MusicService*
- Many-to-many Relationship (DB Schema)
- Web Application Demo
- Many-to-many in Slick Table Definitions
- Ensuring Referential Integrity
- Adding and Deleting Relationships
- Traversing the many-to-many Relationship in Queries

# The Demo App: *MusicService*

- The MusicService manages Music ***Recordings*** and ***Performers***.
- A Recording is ***performedBy*** many (0 ... n) Performers.
- A Performer is ***performingIn*** many (0 ... n) Recordings.



# Many-to-many in the DB Schema

REC_ID	PER_ID
1	1
1	2
1	3
3	1
...	...

RECORDINGS\_PERFORMERS

ID	TITLE	COMPOSER	YEAR
1	Beethoven's Symphony No. 5	Ludwig v. Beethoven	2005
2	Forellenquintett	Franz Schubert	2006
3	Eine kleine Nachtmusik	Wolfgang Amadeus Mozart	2005
4	Entführung aus dem Serail	Wolfgang Amadeus Mozart	2008
...			

RECORDINGS

ID	NAME	PERFORMER_TYPE
1	Arthur Rubinstein	Soloist
2	London Phil. Orch.	Ensemble
3	Herbert von Karajan	Conductor
4	Christopher Park	Soloist
...		

PERFORMERS

# Web Application Demo

*MusicService* is a Play Application with a rather primitive UI. This interface allows the user to ...

- Create, delete, update Performers and Recordings
- Assign Performers to Recordings or Recordings to Performers and delete these Assignments
- Query / Search for Performers and Recordings
- Play Recordings

# Many-to-many Relationship in the Slick Table Definitions

```
case class RecordingPerformer(recId: Long, perId: Long)
```

```
// Table 'RecordingsPerformers' mapped to case class 'RecordingPerformer' as join table to map  
// the many-to-many relationship between Performers and Recordings
```

```
//  
class RecordingsPerformers(tag: Tag)  
  extends Table[RecordingPerformer](tag, "RECORDINGS_PERFORMERS") {  
  
    def recId: Rep[Long] = column[Long]("REC_ID")  
    def perId: Rep[Long] = column[Long]("PER_ID")  
  
    def * = (recId, perId) <> (RecordingPerformer.tupled, RecordingPerformer.unapply)  
    def pk = primaryKey("primaryKey", (recId, perId))  
  
    def recFK = foreignKey("FK_RECORDINGS", recId, TableQuery[Recordings])(recording =>  
      recording.id, onDelete=ForeignKeyAction.Cascade)  
  
    def perFK = foreignKey("FK_PERFORMERS", perId, TableQuery[Performers])(performer =>  
      performer.id)  
  
    // onUpdate=ForeignKeyAction.Restrict is omitted as this is the default  
  }
```

# Ensuring Referential Integrity

- Referential Integrity is guaranteed by the definition of a ***foreignKey()*** function in the referring table, which allows to navigate to the referred table.
- You can optionally specify an ***onDelete*** action and an ***onUpdate*** action, which has one of the following values:
  - ♦ *ForeignKeyAction.NoAction*
  - ♦ *ForeignKeyAction.Restrict*
  - ♦ *ForeignKeyAction.Cascade*
  - ♦ *ForeignKeyAction.SetNull*
  - ♦ *ForeignKeyAction.SetDefault*

# Adding and Deleting Relationships

- Adding a concrete relationship == Adding an entry into the Mapping Table, if it doesn't already exist.
- Deleting a concrete relationship == Deleting an entry from the Mapping Table, if it exists.
- Updates in the Mapping Table do not make much sense. Hence I do not support them in my implementation.

# Traversing many-to-many the Relationship in Queries

- The ***Query.join()*** function allows you to perform an inner join on tables.
- The ***Query.on()*** function allows you to perform an inner join on tables.
- Example:

```
val query = TableQuery[Performers] join TableQuery[RecordingsPerformers] on (_.id === _.perId)
val future: Future[Seq[(Performer, RecordingPerformer)]] = db.run { query.result }
// Now postprocess this future with filter, map, flatMap etc.
// Especially filter the result for a specific recording id.
```

# Links

- Slick Website: <http://slick.typesafe.com/doc/3.1.1/>
- Slick Activator Template Website with Tutorial:  
<https://www.typesafe.com/activator/template/hello-slick-3.1>
- Slick Activator Template Source Code:  
<https://github.com/typesafehub/activator-hello-slick#slick-3.1>
- MusicService Source Code and Slides:  
<https://github.com/hermannhueck/MusicService>

Thank you for listening!



Q & A