Database Access with Slick

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Typesafe
Introduction
WE WRITE SQL
SO YOU DON'T HAVE TO
Write database code in Scala

• Instead of SQL, JPQL, Criteria API, etc.

```scala
for { p <- persons } yield p.name
```

```sql
select p.NAME from PERSON p
```
(for {
    p <- persons.filter(_.age < 20) ++
    persons.filter(_.age >= 50)
    if p.name.startsWith("A")
} yield p).groupBy(_.age).map { case (age, ps) =>
    (age, ps.length)
}

select x2.x3, count(1) from (  
    select * from (  
        select x4."NAME" as x5, x4."AGE" as x3  
            from "PERSON" x4 where x4."AGE" < 20  
        union all select x6."NAME" as x5, x6."AGE" as x3  
            from "PERSON" x6 where x6."AGE" >= 50  
    ) x7 where x7.x5 like 'A%' escape '^'
) x2  
group by x2.x3
Scala Language Integrated Connection Kit

- Database query and access library for Scala
- Successor of ScalaQuery
- Developed at Typesafe and EPFL
- Open Source
Functional-Relational Mapping

- Embraces the relational model
- No impedance mismatch

```scala
class Suppliers ... extends Table[(Int, String, String)]("
"SUPPLIERS")

sup.filter(_.id < 2) ++ sup.filter(_.id > 5)
```
Functional-Relational Mapping

• Composable Queries

```scala
def f(id1: Int, id2: Int) =
    sup.filter(_.id < id1) ++ sup.filter(_.id > id2)

val q = f(2, 5).map(_.name)
```
Functional-Relational Mapping

• Explicit control over statement execution
• Stateless

val result = q.run
Supported Databases

• PostgreSQL
• MySQL
• H2
• Hsqlldb
• Derby / JavaDB
• SQLite
• Access

Closed-Source *Slick Extensions* (with commercial support by Typesafe):

• Oracle
• DB/2
• SQL Server
Architecture
Components

• Lifted Embedding
• Direct Embedding
• Plain SQL
• Session Management
• Schema Model
• Code Generator
Session Management
import scala.slick.driver.H2Driver.simple._

val db = Database.forURL("jdbc:h2:mem:test1", driver = "org.h2.Driver")

db withSession { implicit session =>
  doSomethingWithSession
}

withTransaction
Driver-Independence

class MyDAO(driver: JdbcProfile) {
    import driver.simple._
    ...
}

MultiDBExample and MultiDBCakeExample in https://github.com/slick/slick-examples
Code Generator
sbt Setup

lazy val slick = TaskKey[Seq[File]]("gen-tables")
lazy val slickCodeGenTask =
  (sourceManaged, dependencyClasspath in Compile,
   runner in Compile, streams) map { (dir, cp, r, s) =>
    val outputDir = (dir / "slick").getPath
    val url = "jdbc:h2:~/test"
    val jdbcDriver = "org.h2.Driver"
    val slickDriver = "scala.slick.driver.H2Driver"
    val pkg = "demo"
    toError(r.run(
      "scala.slick.model.codegen.SourceCodeGenerator",
      cp.files, Array(slickDriver, jdbcDriver, url, outputDir, pkg), s.log))
    Seq(file(outputDir + "/demo/Tables.scala"))
  }
Lifted Embedding
class Suppliers(tag: Tag) extends Table[(Int, String, String)](tag, "SUPPLIERS") {
  def id = column[Int]("SUP_ID",
                     O.PrimaryKey, O.AutoInc)
  def name = column[String]("SUP_NAME")
  def city = column[String]("CITY")
  def * = (id, name, city)
}

val suppliers = TableQuery[Suppliers]
Custom Row Types

case class Supplier(id: Int, name: String, city: String)

class Suppliers(tag: Tag) extends Table[Supplier](tag, "SUPPLIERS") {
  def id = column[Int]("SUP_ID", O.PrimaryKey, O.AutoInc)
  def name = column[String]("SUP_NAME")
  def city = column[String]("CITY")
  def * = (id, name, city) <> (Supplier.tupled, Supplier.unapply)
}

val suppliers = TableQuery[Suppliers]
Custom Column Types

class SupplierId(val value: Int) extends AnyVal

case class Supplier(id: SupplierId, name: String, city: String)

implicit val supplierIdType = MappedColumnType.base [SupplierId, Int](_.value, new SupplierId(_))

class Suppliers(tag: Tag) extends Table[Supplier](tag, "SUPPLIERS") {
  def id = column[SupplierId]("SUP_ID", ...)
  ...
}

Custom Column Types

class SupplierId(val value: Int) extends MappedTo[Int]

case class Supplier(id: SupplierId, name: String, city: String)

class Suppliers(tag: Tag) extends Table[Supplier](tag, "SUPPLIERS") {
  def id = column[SupplierId]("SUP_ID", ...)
  ...
}

class Coffees(tag: Tag) extends Table[
    (String, SupplierId, Double)](tag, "COFFEES") {
  def name = column[String]("NAME", O.PrimaryKey)
  def supID = column[SupplierId]("SUP_ID")
  def price = column[Double]("PRICE")
  def * = (name, supID, price)
  def supplier =
    foreignKey("SUP_FK", supID, suppliers)(_.id)
}

val coffees = TableQuery[Coffees]
Creating Tables and Inserting Data

val suppliers = new ArrayBuffer[Supplier]
val coffees = new ArrayBuffer[(String, SupplierId, Double)]

suppliers += Supplier(si1, "Acme, Inc.", "Groundsville")
suppliers += Supplier(si2, "Superior Coffee", "Mendocino")
suppliers += Supplier(si3, "The High Ground", "Meadows")

coffees += Seq(
    ("Colombian", si1, 7.99),
    ("French_Roast", si2, 8.99),
    ("Espresso", si3, 9.99),
    ("Colombian_Decaf", si1, 8.99),
    ("French_Roast_Decaf", si2, 9.99)
)
Auto-Generated Keys

```scala
val ins = suppliers.map(s => (s.name, s.city))
                   returning suppliers.map(_.id)

val si1 = ins += ("Acme, Inc.", "Groundsville")
val si2 = ins += ("Superior Coffee", "Mendocino")
val si3 = ins += ("The High Ground", "Meadows")

coffees += Seq(
    ("Colombian", si1, 7.99),
    ("French_Roast", si2, 8.99),
    ("Espresso", si3, 9.99),
    ("Colombian_Decaf", si1, 8.99),
    ("French_Roast_Decaf", si2, 9.99)
)
```

Queries

val q = for {
  c <- coffees if c.price < 9.0
  s <- c.supplier
} yield (c.name, s.name)

val result = q.run(session)
More Queries

val q1 = suppliers.filter(_.id === 42)
val q2 = suppliers.filter(_.id !== 42)

val q4 = (for {
  c <- coffees
  s <- c.supplier
} yield (c, s)).groupBy(_.2.id).map {
  case (_, q) =>
    (q.map(_.2.name).min.get, q.length)
}

Column[ Option[String] ]

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Plain SQL
def personsMatching(pattern: String)(conn: Connection) = {
  val st = conn.prepareStatement(
    "select id, name from person where name like ?"
  )
  try {
    st.setString(1, pattern)
    val rs = st.executeQuery()
    try {
      val b = new ListBuffer[(Int, String)]
      while (rs.next)
        b.append((rs.getInt(1), rs.getString(2)))
      b.toList
    } finally rs.close()
  } finally st.close()
}
Slick

def personsMatching(pattern: String)(implicit s: Session) =
sql"select id, name from person where name like $pattern"
.as[(Int, String)].list
Outlook
Slick 2.0 – What's New

• Improved API
• Code Generator
• Query scheduling (experimental)
• New driver and back-end architecture
Outlook

• Slick 2.1: Focus on usability (API, docs, semantics, etc.)
• Default database library for Play 2.3
  – as part of the Typesafe Platform
• Macro-based type providers
  – Prototype based on type macros (*topic/type-providers*)
  – Macro annotations should be enough
  – Scala 2.12? Dotty?
• Investigating async support and Java API
Getting Started

- Typesafe Activator:
  http://typesafe.com/activator
slick.typesafe.com

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