Database Access with Slick

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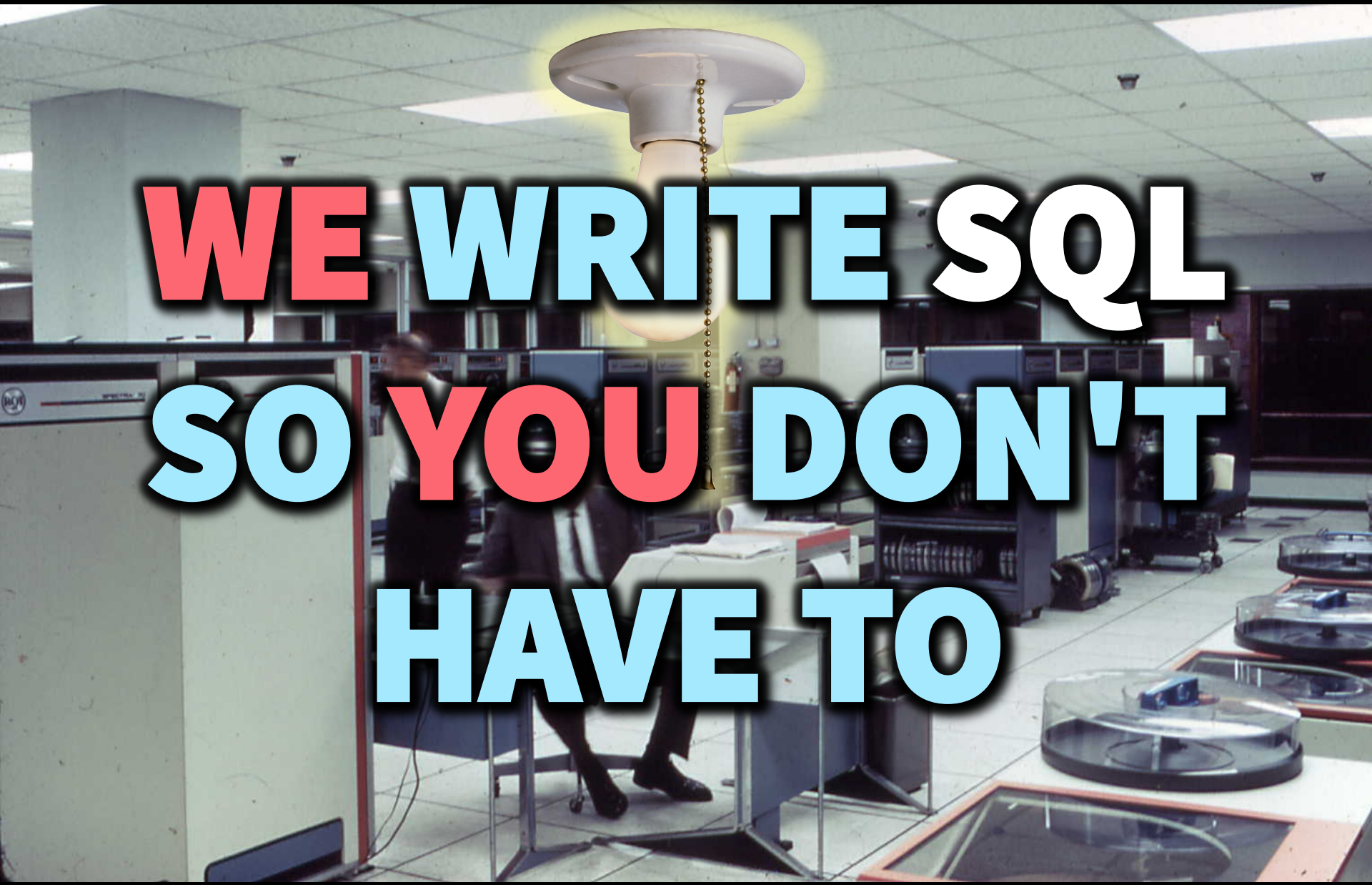
Scalapeño 2013



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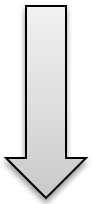
NOAA's National Climatic Data Center is the source of this image and it is used by permission

Write database code in Scala

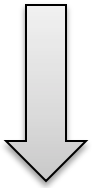
- Instead of SQL, JPQL, Criteria API, etc.

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



```
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
```

INTRODUCTION

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
- Composable Queries
- Explicit control over statement execution
- Stateless

Supported Databases

- PostgreSQL
- MySQL
- H2
- Hsqldb
- Derby / JavaDB
- SQLite
- Access

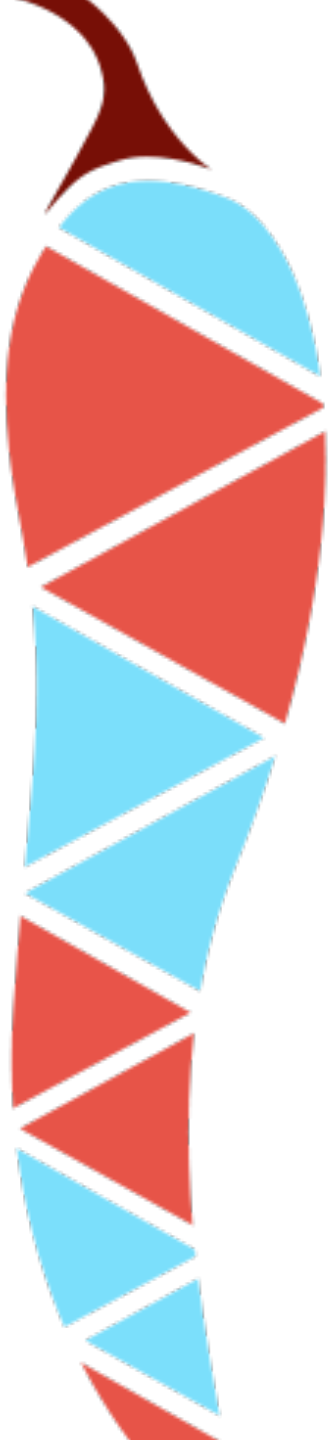
Closed-Source *Slick Extensions* (with commercial support by Typesafe):

- Oracle
- DB/2
- SQL Server

ARCHITECTURE

Components

- Lifted Embedding
- Direct Embedding
- Plain SQL
- Session Management
- Schema Model



SESSION MANAGEMENT

Unified 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
}
```

- forName
- forDataSource

withTransaction

Driver-Independence

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

BasicProfile
↳ RelationalProfile
↳ SqlProfile
↳ JdbcProfile

➡ MultiDBExample and MultiDBCakeExample in https://github.com/slick/slick-examples

LIFTED EMBEDDING

Table Definition

```
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]
```

Table Definition

```
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 id: Int) extends AnyVal

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

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

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

Foreign Keys

```
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)
)
```

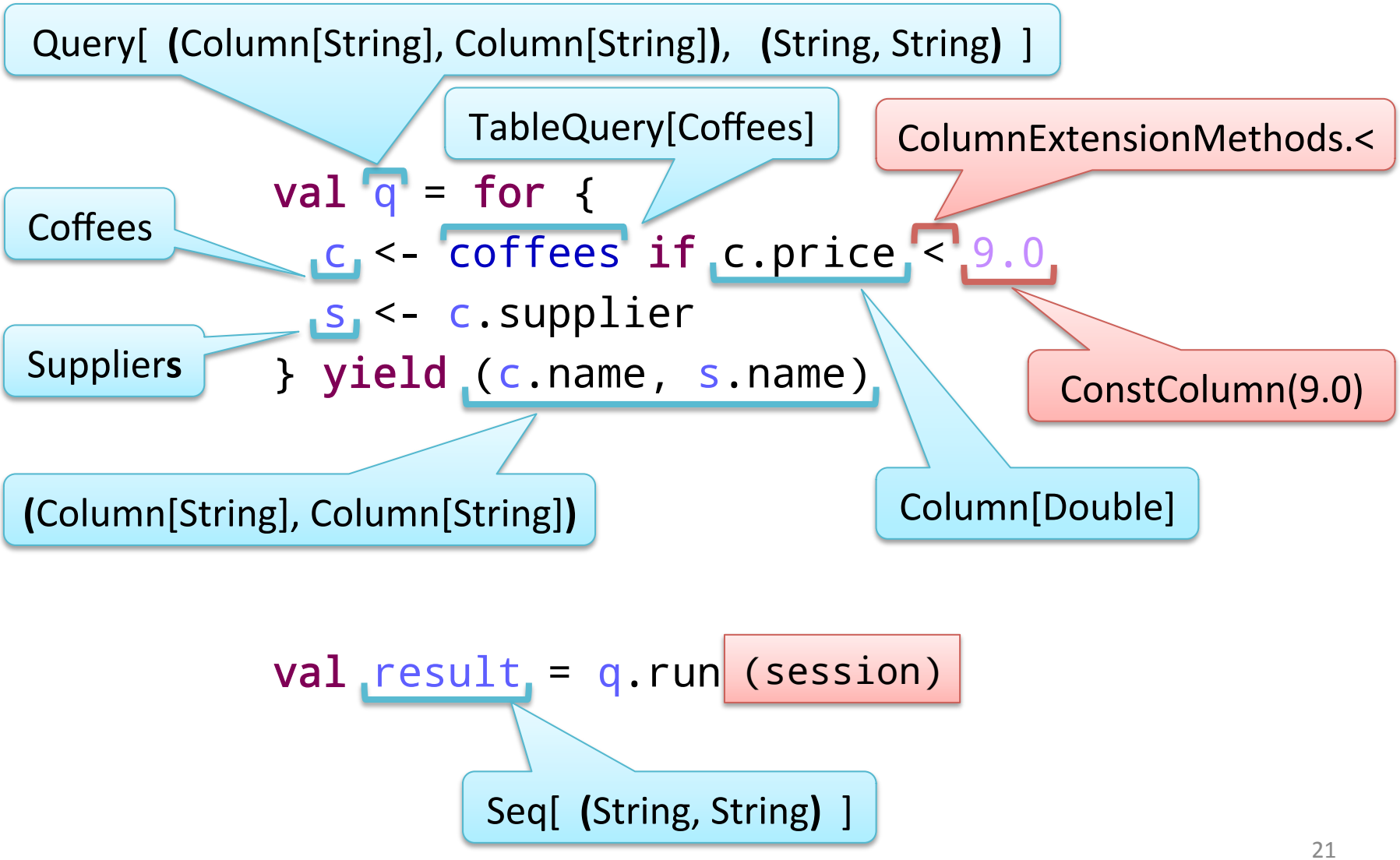
Auto-Generated Keys

```
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


Query[(Column[String], Column[String]), (String, String)]
TableQuery[Coffees]
ColumnExtensionMethods.<
Coffees
Suppliers
val q = for {
c <- coffees if c.price < 9.0
s <- c.supplier
} yield (c.name, s.name)
ConstColumn(9.0)
(Column[String], Column[String])
Column[Double]
val result = q.run (session)
Seq[(String, String)]

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]**]

PLAIN SQL

JDBC

```
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 session: Session) =
  sql"select id, name from person where name like $pattern"
    .as[(Int, String)].list
```

OUTLOOK

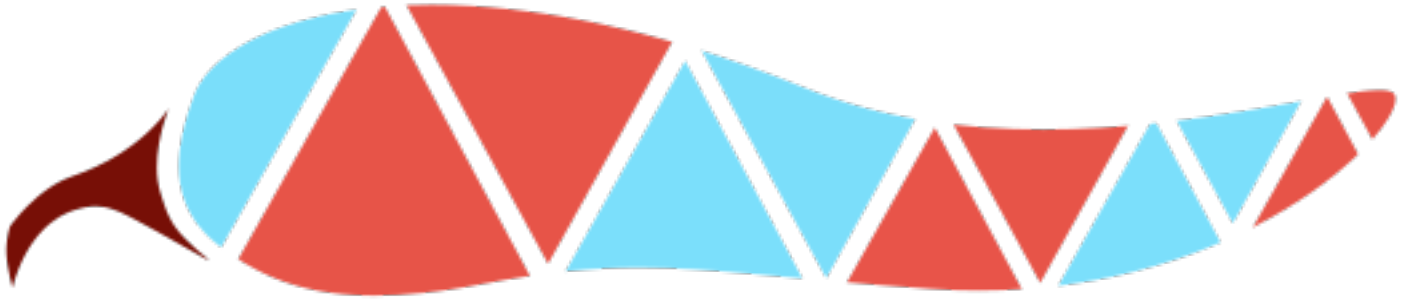
Slick 2.0

- Coming Q3 / 2013
- Query scheduling
- API Improvements
- New driver and backend architecture
- Generate Slick code from database schemas

- **This presentation is based on 2.0.0-M2**

Outlook

- MongoDB (scheduled for Q1/2014)
- Asynchronous, non-blocking API
- Macro-based type providers (Scala 2.12?)
- Default database library for Play



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