AppsFlyer Engineering

Help the compiler help you

Leveraging Scala's implicits for code safety

Scala meetup - September 2022

What will we talk about?

01

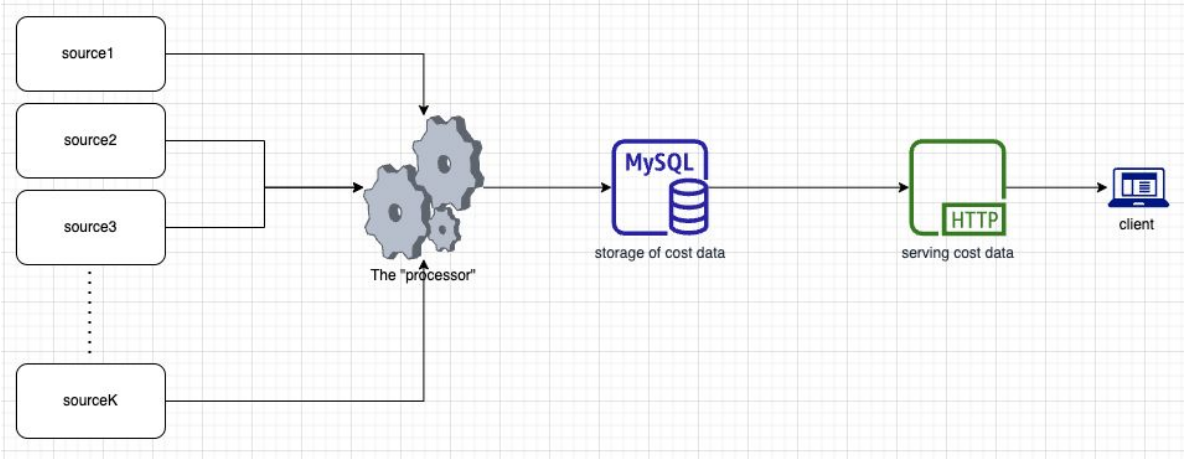
"TODO or not TODO"?
A day in the life of a SW engineer

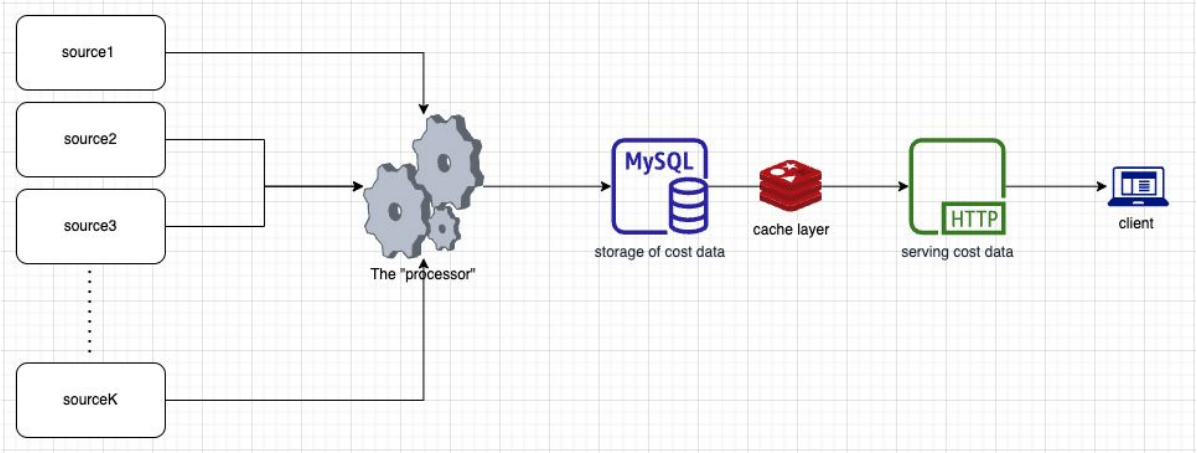
02

"let's make it right, shall we?"

- Chapter 1 -

“TODO or not TODO”?
A day in the life of a SW engineer


source1
source2
source3
sourceK
The "processor"
MySQL
storage of cost data
HTTP
serving cost data
client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```scala
sealed trait CostModel {
  val cost: Double
  val date: LocalDate
  val accountId: AccountId

  override def toString: String =
    """
      |cost: $cost
      |date: $date
      |accountId: $accountId
      |""".stripMargin
}

//cost per install
case class CPI(cost: Double,
               date: LocalDate,
               accountId: AccountId,
               countryCode: String)
    extends CostModel

//cost per action
case class CPA(cost: Double,
               date: LocalDate,
               accountId: AccountId,
               channel: String)
    extends CostModel
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TODO:

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TODO:

- ➢ create redis client
- ➢ Generate for each model, a proper redis key
- ➢ On given request, check in redis by key. If not found, ask DB
- ➢ Later on, store the result in redis, with the generated key

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```

We run our code and...

```
Exception in thread "main" java.lang.Exception Create breakpoint : NOAUTH Authentication required.
    at com.redis.Reply$$anonfun$errReply$1.applyOrElse(RedisProtocol.scala:132)
    at com.redis.Reply$$anonfun$errReply$1.applyOrElse(RedisProtocol.scala:131)
    at scala.runtime.AbstractPartialFunction.apply(AbstractPartialFunction.scala:38)
    at com.redis.Reply$$anonfun$bulkReply$1.applyOrElse(RedisProtocol.scala:91)
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    at scala.PartialFunction$OrElse.apply(PartialFunction.scala:172)
    at com.redis.Reply.receive(RedisProtocol.scala:152)
    at com.redis.Reply.receive$(RedisProtocol.scala:148)
    at com.redis.Redis.receive(RedisClient.scala:34)
    at com.redis.R.asBulk(RedisProtocol.scala:255)
    at com.redis.R.asBulk$(RedisProtocol.scala:255)
    at com.redis.Redis.asBulk(RedisClient.scala:34)
    at com.redis.StringOperations.$anonfun$get$1(StringOperations.scala:24)
    at com.redis.Redis.send(RedisClient.scala:45)
    at com.redis.StringOperations.get(StringOperations.scala:24)
    at com.redis.StringOperations.get$(StringOperations.scala:23)
    at com.redis.RedisCommand.get(RedisClient.scala:96)
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private def authenticateRedisClient(redisClient: RedisClient,
                                    secret: String): Unit = {
  val res = redisClient.auth(secret)

  if (!res){
    throw new Exception("can't authenticate redis!")
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What are the possible problems with this implementation?

1. Should we wait for redis usage to authenticate and throw? Or put it all in `main`?

2. `getCostFromCache`, `setToCache` methods receives a `redisClient`. No indication of it's "authentication" state!

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3. Generation of the "redis key"

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What are the possible problems with this implementation?

1. Should we wait for redis usage to authenticate and throw? Or put it all in `main`?
2. `getCostFromCache`, `setToCache` methods receives a `redisClient`. No indication of it's "authentication" state!
3. Generation of the "redis key"
4. How to test methods which require `RedisClient`?

- Chapter 2 -

“let's make it right, shall we?”

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TODO:

```scala
implicit val redisClient: RedisClient = new RedisClient("host", 6379)
```

TODO:

- Allow testability to methods using `RedisClient`
- “Embed” somehow the “authentication” state in the `RedisClient`
- Methods to receive already authenticated client!
- Better “key generation” than string interpolation!

TODO:

- Allow testability to methods using `RedisClient`

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- Allow testability to methods using `RedisClient`

Solution:

- “Tagless final” approach

```scala
trait RedisOpsT {
  def authenticate(secretKey: String): Unit
  def get(key: String): Option[String]
  def set(key: String, value: Any): Boolean
}
```

TODO:

- Allow testability to methods using `RedisClient`

Solution:

- “Tagless final” approach
  a. define an “algebra”

```scala
trait RedisOpsT {

  def authenticate(secretKey: String): Unit

  def get(key: String): Option[String]

  def set(key: String, value: Any): Boolean

}

case class RedisOpsSingleThread(redisClient: RedisClient) extends RedisOpsT {
  override def authenticate(secretKey: String): Unit = {
    val res = redisClient.auth(secretKey)

    //TODO return as value. Try / Either or others..
    if (!res) {
      throw new Exception(f"Could not authenticate redis")
    }
  }

  override def get(key: String): Option[String] = {
    redisClient.get[String](key)
  }

  override def set(key: String, value: Any): Boolean =
    redisClient.set(key, value)
}
```

TODO:

- Allow testability to methods using `RedisClient`

Solution:

- “Tagless final” approach
  a. define an “algebra”
  b. implement “interpreters”

```scala
trait RedisOpsT {

  def authenticate(secretKey: String): Unit

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case class RedisOpsSingleThread(redisClient: RedisClient) extends RedisOpsT {
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  }

  override def get(key: String): Option[String] = {
    redisClient.get[String](key)
  }

  override def set(key: String, value: Any): Boolean =
    redisClient.set(key, value)
}
object RedisOpsSingleThread {
  def apply(host: String, port: Int): RedisOpsSingleThread = {
    val redisClient: RedisClient =
      new RedisClient(host, port)
    RedisOpsSingleThread(redisClient)
  }
}
```

TODO:

- Allow testability to methods using `RedisClient`

Solution:

- “Tagless final” approach
  a. define an “algebra”
  b. implement “interpreters”

```scala
trait RedisOpsT {

  def authenticate(secretKey: String): Unit

  def get(key: String): Option[String]

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case class RedisOpsSingleThread(redisClient: RedisClient) extends RedisOpsT {
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object RedisOpsSingleThread {
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    RedisOpsSingleThread(redisClient)
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```

TODO:

- Allow testability to methods using RedisClient

```scala
val clientForTesting = new RedisOpsT {
  override def authenticate(secret: String): Unit =
    println("you are set to go")

  override def get(key: String): Option[String] =
    Some("42") // why 42?

  override def set(key: String, value: Any): Boolean = {
    println(s"setting key: $key with value $value")
    true
  }
}
```

```scala
def main(args: Array[String]): Unit = {
   implicit val redisClient: RedisClient = new RedisClient("host", 6379)
   authenticateRedis(redisClient, "secret")
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 }

def handleCostRequest(request: CostHttpRequst)
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  IO[HttpResponse] = {
  for {
    costResult ← getCost(request.accountId,
                         request.date,
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```scala
def main(args: Array[String]): Unit = {
    implicit val redisClient: RedisOpsT = RedisOpsSingleThread("host", 9379)
    redisClient.authenticate("secret")
    println("cost serving http server has started..")

    startHttpServer()
  }
```

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Solution:

- Phantom Types!

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trait RedisOpsT {
  def authenticate(secretKey: String): Unit
  def get(key: String): Option[String]
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  - Add a type constraint on our trait

```scala
trait RedisOpsT[S <: RedisOpsT.State] {

  def authenticate(secret: String): RedisOpsT[State.Authenticated]

  def get[S <: State.Authenticated](key: String): Option[String]

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  - Add a type constraint on our trait
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```scala
case class RedisOpsSingleThread(redisClient: RedisClient) extends RedisOpsT {
  override def authenticate(secretKey: String): Unit = {
    val res = redisClient.auth(secretKey)

    //TODO return as value. Try / Either or others..
    if (!res) {
      throw new Exception(f"Could not authenticate redis")
    }
  }

  override def get(key: String): Option[String] = {
    redisClient.get[String](key)
  }

  override def set(key: String, value: Any): Boolean =
    redisClient.set(key, value)
}

object RedisOpsSingleThread {
  def apply(host: String, port: Int): RedisOpsSingleThread = {
    val redisClient: RedisClient =
      new RedisClient(host, port)
    RedisOpsSingleThread(redisClient)
  }
}
```

TODO:

- "Embed" somehow the "authentication" state in the `RedisClient`

Solution:

- Phantom Types!
  - Build the "states" as `sealed trait` inside the `RedisOpsT` companion object
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```scala
case class RedisOpsSingleThread[S <: State](redisClient: RedisClient)
    extends RedisOpsT[S] {
  override def authenticate(secretKey: String): RedisOpsT[State.Authenticated] = {
  redisClient
    .auth(secretKey)
    .fold(
      //return new RedisOps with Authenticated state
      RedisOpsSingleThread[State.Authenticated](redisClient),
      throw new Exception(f"Could not authenticate redis")
    )
}

  override def get[S <: State.Authenticated](key: String): Option[String] = {
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object RedisOpsSingleThread {
  def apply(host: String, port: Int):
    RedisOpsSingleThread[State.UnAuthenticated] = {
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TODO:

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def handleCostRequest(request: CostHttpRequst)
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  IO[HttpResponse] = {
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def main(args: Array[String]): Unit = {
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  redisClient.get(s"$costType-$id-$date") }

private def setToCache(costRes: CostModel)
    (implicit redisClient: RedisOpsT[State.Authenticated]) =
  redisClient.set(
    key = s"${costRes.costType}-${costRes.accountId}-${costRes.date}",
    value = toJson(costRes))
```

```scala
def main(args: Array[String]): Unit = {
    implicit val redisClient: RedisOpsT[State.UnAuthenticated] =
      RedisOpsSingleThread("host", 9379)

    println("cost serving http server has started..")

    startHttpServer()
  }
def handleCostRequest(request: CostHttpRequest)
                     (implicit redisClient: RedisOpsT[State.UnAuthenticated]):
  IO[HttpResponse] = {
  for {
    costResult ← getCost(request.accountId,
                         request.date,
                         request.costModel)
    _ ← logger.info(s"received: $costResult")
    _ ← setToCache(costResult)
  } yield buildRespons(costResult)
}

private def getCost(accountId: AccountId,
                    date: LocalDate,
                    costType: CostType)
  (implicit redisClient: RedisOpsT[State.UnAuthenticated]
): IO[CostModel] = {
  val authenticatedRedisClient = redisClient.authenticate("secret")
  getCostFromCache(accountId, date, costType)
    (authenticatedRedisClient).map(
    _.getOrElse(getCostFromDB(accountId, date, costType))
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What if we do a redisClient.get on an UnAuthenticated client?

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```

What if we do a redisClient.get on an UnAuthenticated client?

```
inferred type arguments
[String,com.appsflyer.cost.common.redis.RedisOpsT.State.UnAuthenticated]
        do not conform to method get's type parameter bounds [
        com.appsflyer.cost.common.redis.RedisOpsT.State.UnAuthenticated <:
        com.appsflyer.cost.common.redis.RedisOpsT.State.Authenticated]
  redisClient.get("someKey")
```

Build will fail!

```scala
def main(args: Array[String]): Unit = {
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TODO:

- ✓ Allow testability to methods using RedisClient
- “Embed” somehow the “authentication” state in the RedisClient
- Methods to receive already authenticated client!
- Better “key generation” than string interpolation!

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Solution:

- Type class

```scala
trait RedisOpsT[S <: RedisOpsT.State] {
  def authenticate(secret: String): RedisOpsT[State.Authenticated]
  def get[S <: State.Authenticated](key: String): Option[String]
  def set[S <: State.Authenticated](key: String, value: Any): Boolean
}
```

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TODO:

- Better “key generation” than string interpolation!

Solution:

- Type class
  - Add a type to “key” param

```scala
trait RedisOpsT[K: RedisKeyGenerator, S <: RedisOpsT.State] {

  def authenticate(secret: String): RedisOpsT[State.Authenticated]

  def get[K: RedisKeyGenerator, S <: State.Authenticated]
      (key: K): Option[String]

  def set[K: RedisKeyGenerator, S <: State.Authenticated]
      (key: K, value: Any): Boolean

}
```

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      (key: K, value: Any): Boolean

}

case class RedisOpsSingleThread[S <: State](redisClient: RedisClient)
    extends RedisOpsT[S] {
  override def authenticate(secretKey: String):
      RedisOpsT[State.Authenticated] = {
  redisClient
    .auth(secretKey)
    .fold(
      //return new RedisOps with Authenticated state
      RedisOpsSingleThread[State.Authenticated](redisClient),
      throw new Exception(f"Could not authenticate redis"))
}

  override def get[K: RedisKeyGenerator, S <: State.Authenticated]
      (key: String): Option[String] = {
    redisClient.get[String](RedisKeyGenerator[K].toKey(key))
  }

  override def set[K: RedisKeyGenerator, S <: State.Authenticated]
      (key: String, value: Any): Boolean =
    redisClient.set(RedisKeyGenerator[K].toKey(key), value)
}
```

TODO:

- Better “key generation” than string interpolation!

Solution:

- Type class
  - Add a type to “key” param
  - Align all extended classes

```scala
trait RedisOpsT[K: RedisKeyGenerator, S <: RedisOpsT.State] {

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TODO:

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Solution:

- Type class
  - Add a type to “key” param
  - Align all extended classes
  - Build the type class!

```scala
trait RedisKeyGenerator[K] {
  def toKey(k: K): String
}

object RedisKeyGenerator {
  def apply[K](implicit r: RedisKey[K]):
    RedisKeyGenerator[K] = r

  def redisKey[K: RedisKey](k: K): String =
    RedisKeyGenerator[K].toKey(k)

  object RedisKeyGeneratorOps {
    implicit val stringRedisKey: RedisKeyGenerator[String] =
    (k: String) ⇒ k
  }
}
```

TODO:

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  - Align in code

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private def setToCache(costRes: CostModel)
    (implicit redisClient: RedisOpsT[State.Authenticated]) =
  redisClient.set(
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    value = toJson(costRes))
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```scala
sealed trait CostModel {
  val cost: Double
  val date: LocalDate
  val accountId: AccountId

  override def toString: String =
    """
      |cost: $cost
      |date: $date
      |accountId: $accountId
      |""".stripMargin
}
```

TODO:

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object CostModel {

  implicit redisKeyGen: RedisKeyGenerator[CostModel] =
    (c: CostModel ⇒ s"${c.costType}-${c.accountId}-${c.date}"")
}
```

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def main(args: Array[String]): Unit = {
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private def getCost(accountId: AccountId,
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   startHttpServer()
 }

def handleCostRequest(request: CostHttpRequst)
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}

private def getCost(accountId: AccountId,
                    date: LocalDate,
                    costType: CostType)
  (implicit redisClient: RedisClient
): IO[CostModel] = {
  getCostFromCache(accountId, date, costType).map(
    _.getOrElse(getCostFromDB(accountId, date, costType))
  )
}

private def getCostFromCache(id: AccountId,
                             date: LocalDate,
                             costType: CostType)
  (implicit redisClient: RedisClient
): IO[Option[CostModel]] = IO {
  redisClient.get(s"$costType-$id-$date") }

private def setToCache(costRes: CostModel)
    (implicit redisClient: RedisClient) =
  redisClient.set(
    key = s"${costRes.costType}-${costRes.accountId}-${costRes.date}",
    value = toJson(costRes))
```

```scala
def main(args: Array[String]): Unit = {
    implicit val redisClient: RedisOpsT[State.UnAuthenticated] =
      RedisOpsSingleThread("host", 9379)

    println("cost serving http server has started..")

    startHttpServer()
  }
def handleCostRequest(request: CostHttpRequst)
                     (implicit redisClient: RedisOpsT[State.UnAuthenticated]):
  IO[HttpResponse] = {
  for {
    costResult ← getCost(request.accountId,
                         request.date,
                         request.costModel)
    _ ← logger.info(s"received: $costResult")
    _ ← setToCache(costResult)
  } yield buildRespons(costResult)
}

private def getCost(accountId: AccountId,
                    date: LocalDate,
                    costType: CostType)
  (implicit redisClient: RedisOpsT[State.UnAuthenticated]
): IO[CostModel] = {
  val authenticatedRedisClient = redisClient.authenticate("secret")
  getCostFromCache(accountId, date, costType)
    (authenticatedRedisClient).map(
    _.getOrElse(getCostFromDB(accountId, date, costType))
  )
}
private def getCostFromCache(id: AccountId,
                             date: LocalDate,
                             costType: CostType)
  (implicit redisClient: RedisOpsT[State.Authenticated]
): IO[Option[CostModel]] = IO {
  redisClient.get(s"$costType-$id-$date") }

private def setToCache(costRes: CostModel)
    (implicit redisClient: RedisOpsT[State.Authenticated]) =
  redisClient.set(
    key = costRes,
    value = toJson(costRes))
```

- Thank you -