EFF MONAD

ONE MONAD TO CONTROL THEM ALL

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AGENDA

- What are effects?
- How do I use one effect?
- How do I use many effects?
- Eff Monad
- The problems Eff solves
- How Eff works
- How you can use it
- Conclusion

EFFECTS

- What are effects?

EFFECTS

- **Option[A]**: may or may not contain a value **A.**
- **Either[A, B]**: either contains a value **A** or a value **B**.
- **Future[A]**: may return a value of type **A** in the future.

HOW DO I USE ONE EFFECT?

OF THE SAME TYPE: OPTION[A]

```
for {
  person1 <- Some("James")
  person2 <- Some("Mary")
  person3 <- Some("Bob")
} yield s"Hello $person1, $person2, and $person3"

// Some("Hello James, Mary, and Bob")
```

```
for {
  person1 <- Some("James")
  person2 <- None
  person3 <- Some("Bob")
} yield s"Hello $person1, $person2, and $person3"

// None
```

HOW DO I USE ONE EFFECT?

OF THE SAME TYPE (FUTURE[A])

```
for {
  person1 <- Future.successful("James")
  person2 <- Future.successful("Mary")
  person3 <- Future.successful("Bob")
} yield s"Hello $person1, $person2, and $person3"

// Success("Hello James, Mary, and Bob")
```

```
for {
  person1 <- Future.successful("James")
  person2 <- Future.failed(new Exception("Person2 not found"))
  person3 <- Future.successful("Bob")
} yield s"Hello $person1, $person2, and $person3"

// Failure(Exception("Person2 not found"))
```

HOW DO I USE TWO EFFECTS?

EITHER[ERROR, _] + FUTURE[_]

```scala
case class User(email: String)
case class Error(message: String)

def isValidEmail(email: String): Either[Error, String] =
  Either.cond(email.contains("@neopets.com"), email, Error("Lame email address"))

def getUserByEmail(email: String): Future[Either[Error, User]] =
  Future.successful(Right(User(email)))
```

```scala
def getUser(email: String): Future[Either[Error, User]] = for {
  validEmail <- isValidEmail(email)
  user <- getUserByEmail(validEmail)
} yield user

getUser("mary@neopets.com") // Success(Right(User("mary@neopets.com")))
```

NOT POSSIBLE

A FEW SOLUTIONS

- Monad transformers
- Free Monad

EFF!

THE EFF MONAD

HISTORY

Introduced in the paper: Freer monads, more extensible effects

Introduced to scala by: atnos-org/eff

THE PROBLEMS IT SOLVES

- Combining multiple effects (which can be painful as we've seen)
- Declaratively specifying what your program *does*
  - By separating your program's *description* from its *interpretation*
  - With effect handers

HOW EFF WORKS

You define a type-level list of "effect constructors"

```scala
import org.atnos.eff._
import org.atnos.eff.all._
import org.atnos.eff.syntax.all._
import monix.eval.Task // we use Task to wrap Futures

type EitherError[A] = Either[Error, A] // A monad is a single arity type constructor

type Stack = Fx.fx2[EitherError, Task] // Your effect stack

type _eitherError[R] = EitherError |= R // EitherError is a member of R
```

USING EFF

```scala
import org.atnos.eff.addon.monix.task._

def getUser[R : _eitherError : _task](email: String): Eff[R, Either[Error, User]] = for
  email <- fromEither(isValidEmail(email))
  user <- fromTask(Task.fromFuture(getUserByEmail(email)))
} yield user
```

```scala
val prog = getUser[Stack]("mary@neopets.com") // Eff.ImpureAp(...) - description

val task = prog.runEither.runAsync // Task[Either[Error, User]] - interpretation

Await.result(task.runAsync, 10.seconds) // Right(User("mary@neopets")) - result
```

WAT.

- Where did `fromEither` etc. come from?
- Eff provides these functions to lift your monad into `Eff`
- There are similar lifting functions for many commonly used types:
  - State
  - Reader
  - cats.effect.IO
  - etc.
- You can define your own effects!

EASY MOCKING

- We can pass parameters to our interpreters
- A notorious problem in testing is how do you pass time into your app?
  - Using `Time.now()` in your app prevents you from mocking time in tests

```
import io.pjan.effx.time._

type Stack = Fx.fx2[EitherError, Time]

def emailAndTime[R : _eitherError : _time](email: String): Eff[R, Either[Error, (String
  email <- fromEither(isValidEmail(email))
  time <- timestamp
} yield (email, time)

val prog = getUser[Stack]("mary@neopets.com")
```

DEFINING TIME

Define what *time* means in your app

In production

```
val liveResult = prog.runEither.runTime(Clock.live) // Pass the interpreter a live Cloc
```

In tests

```
val newYearTime = OffsetDateTime.of(2018, 1, 1, 0, 0, 0, 0, ZoneOffset.UTC)

val frozenResult = prog.runEither.runTime(Clock.frozen(newYearTime)) // Pass it a froze
```

CONCLUSION

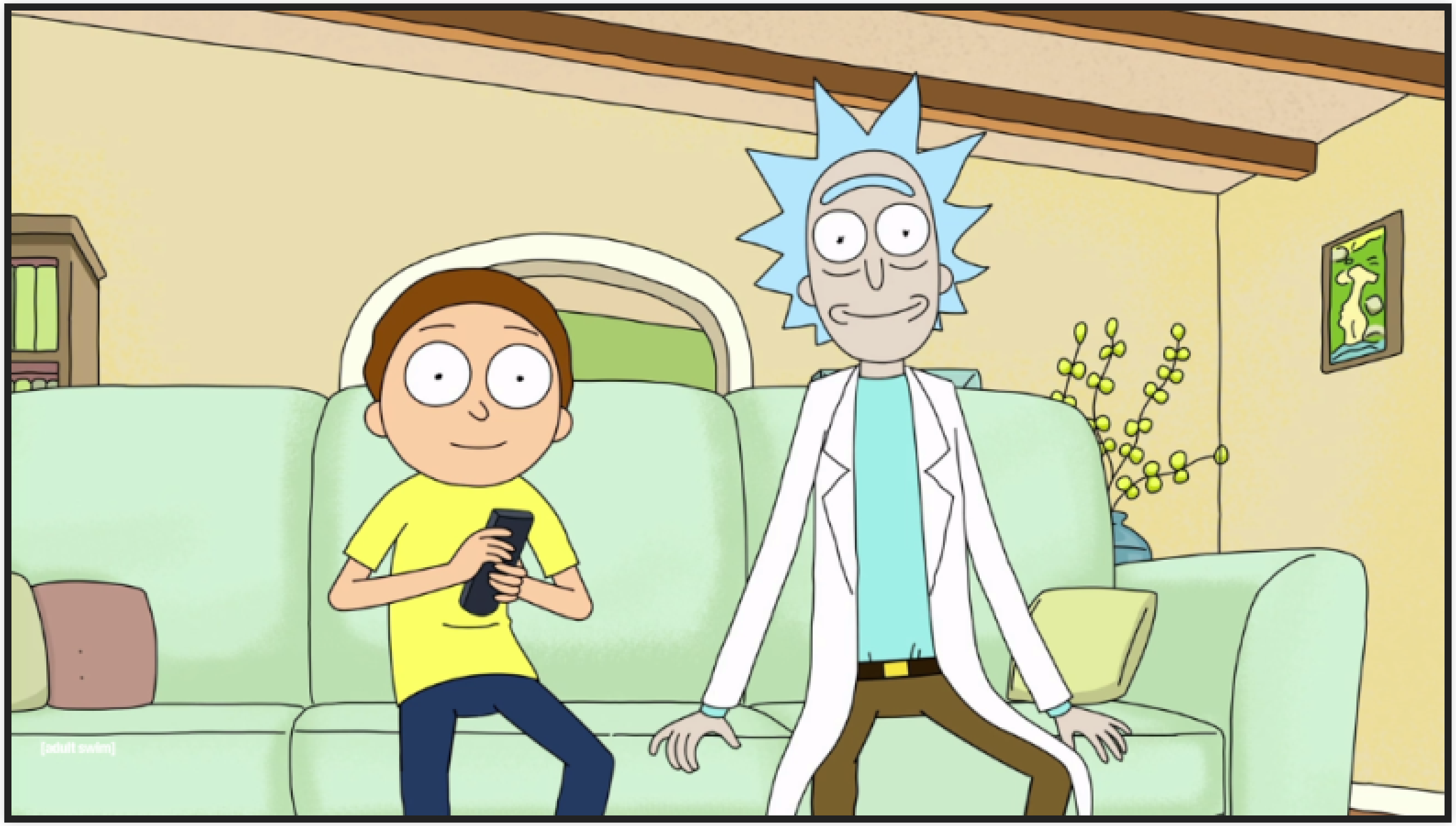
Eff provides you fine grained control over how your code behaves

Great documentation, go check it out!

Overhead, this stuff is not easy

BUT IT'S WORTH IT!

QUESTIONS?



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