

# Idris

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# Idris

- ▶ Haskell-подобный,
- ▶ с зависимыми типами,
- ▶ с опциональной проверкой на тотальность,
- ▶ строгий по-умолчанию,
- ▶ с тактиками,
- ▶ ...

# Haskell-подобный

```
data MyList a = Nil | (::) a (MyList a)

(++) : MyList a -> MyList a -> MyList a
Nil ++ ys = ys
(x :: xs) ++ ys = x :: (xs ++ ys)

instance Functor MyList where
    map f Nil = Nil
    map f (x :: xs) = f x :: map f xs
```

# Haskell-подобный

```
data MyList a = Nil | (::) a (MyList a)
```

```
instance Applicative MyList where
  pure x = [x]
  [] <$> _ = []
  (f :: fs) <$> xs = map f xs ++ (fs <$> xs)
```

```
instance Monad MyList where
  [] >>= _ = []
  (x :: xs) >>= f = f x ++ (xs >>= f)
```

```
test : MyList Int
test = do
  f <- [id, (*2)]
  x <- [3, 4]
  return $ f x
```

## С зависимыми типами

```
data MyVect : Nat -> (a : Type) -> Type where
  Nil : MyVect 0 a
  (::) : a -> MyVect n a -> MyVect (S n) a

(++) : MyVect n a -> MyVect m a -> MyVect (n + m) a
[] ++ ys = ys
(x :: xs) ++ ys = x :: (xs ++ ys)

infix 9 !!

(!!) : MyVect n a -> Fin n -> a
(x :: xs) !! fZ = x
(x :: xs) !! (fS y) = xs !! y
```

## С опциональной проверкой на тотальность

```
total myHead : List a -> a
myHead (x :: xs) = x
```

Main.myHead is not total as there are missing cases

```
%default total
go : Int
go = go
```

Main.go is possibly not total due to recursive path  
Main.go

В интерпретаторе:

```
> :total f
```

В типах вычисляются только тотальные функции.

# Строгий по-умолчанию

```
broken : Int -> Int
broken 0 = 1
broken n = n * broken (n - 1)

ifThenElse : Bool -> a -> a -> a
ifThenElse True t _ = t
ifThenElse False _ f = f

> ifThenElse True 0 (broken (-1))
```

Интерпретатор:

```
0 : Int
```

Скомпилированный код (с точностью до оптимизаций):

```
segmentation fault ./a.out
```

# С тактиками

```
lemma_applicative_identity : (vs : MyList a)
  -> (pure id <$> vs = vs)
lemma_applicative_identity [] = refl
lemma_applicative_identity (v :: vs) =
  let rec = lemma_applicative_identity vs
  in ?lemma_applicative_identity_rhs

lemma_applicative_identity_rhs = proof
  intro a,x,xs,rec
  rewrite rec
  trivial
```



...

► Именованные инстансы

```
instance [myord] Ord Int where
    ...
    sort @{myord} [2, 1, 3]
```

► Idiom brackets(для аппликативных функторов)

```
f : Maybe Int -> Maybe Int -> Maybe Int
f x y = [| x + y |]
```

...

► !-нотация(для монад)

```
g : Maybe Bool -> Maybe a -> Maybe a -> Maybe a
g x t f = if !x then t else f
```

► Опциональная ленивость

```
data Lazy : Type -> Type where
  Delay : a -> Lazy a
```

```
Force : Lazy a -> a
```

► Изменяемый синтаксис

```
syntax if [test] then [t] else [e] = boolElim test
      (Delay t) (Delay e)
```

...

- ▶ Минимальный вывод типов в `where`
- ▶ Гетерогенное равенство

```
data (=) : a -> b -> Type where  
  refl : x = x
```

- ▶ FFI with C TODO

...

- ▶ `public`, `abstract`, `private` спецификаторы видимости

```
%access public  
abstract f : Int -> Int
```

- ▶ `records`

```
record R : Type where  
  MkR : (f1 : Int) -> (f2 : String) -> R
```

- ▶ Levels are implicit TODO
- ▶ auto implicit args TODO

# Effects вместо трансформеров

```
f : { [STDIO, STATE Int] } Eff ()
```

# Type providers

```
%language TypeProviders
```

```
strToType : String -> Type
```

```
strToType "Int" = Int
```

```
strToType _ = Nat
```

```
fromFile : String -> IO (Provider Type)
```

```
fromFile fname = Provide (strToType (trim !(readFile  
    fname)))
```

```
%provide (T : Type) with fromFile "config.h"
```

```
f : T
```

```
f = 42
```

# TODOs

- ▶ Proof automation
- ▶ More better termination checker
- ▶ More better editor support (goto definition, autocomplete, ...)
- ▶ More bindings (incl. low-level C bindings)
- ▶ More backends (e.g. GHC)
- ▶ Bugfixing