

An Intro to Dependent Types with Idris

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Problems with regular type systems

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```
2   head []
   -- *** Exception: Prelude.head: empty list

4   printf "blah %s %s" "hello"
   -- *** Exception: printf: argument list ended
6   -- prematurely
```

What causes these problems?

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- Most functional languages have two languages that can't interact: the Type language, and the programming language
 - Types exist only as an enforcement layer
- Since these languages can't interact, all the types and conditions for them must be known by the programmer ahead of time, and can't can't be deduced from the context of the code.

The solution to these problems (and many others) are
dependent types

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Common languages for it are:

- Agda
- Coq
- F*

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- Idris is a Haskell-like language by Edwin Brady
 - Similar syntax, but not lazy
- Dependent types are a main feature, but less dogmatic than Agda
 - Long-term goals are dependently typed system drivers
- Outputs to C, LLVM, JavaScript, and PHP
 - Making a new backend can usually be done in <500 LOC

A safe list with a length

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- Even getting the length requires $O(n)$ operations.
 - You could store the length as a property, but that requires anyone who updates length to make sure it's updated

A safe list with a length

Let's code it!

A safe printf (or any variadic function)

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- Mixing types (like in printf) generally eschews compiler type-safety
- Compiler can't check to see if you have the correct number of arguments

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More coding!

A note about compiler hacks

F#'s `printfn` works as you would expect due to a special case in the compiler doing static analysis on that particular case.

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This is totes OK, but that only works for that particular case.

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- Quick example

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fiveIsFive : 5 = 5  
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 - (I'm still learning how to use them)