Homotopy Type Theory in Agda

17/7/7
Goal

synthetic homotopy theory in Agda

+ other needed theories
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synthetic homotopy theory in Agda + other needed theories

Agda and Coq were the only two immediately usable systems for HoTT
Decentralized Dev.

HoTT/Agda-HoTT
favonia/homotopy [obsolete]
nicolaikraus/HoTT-Agda [fork]
dlicata335/hott-agda

...
Decentralized Dev.

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guillaumebrunerie/JamesConstruction
...

porting theorems and forking are common
Decentralized Dev.

\[\text{HoTT/Agda-HoTT}\]

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... porting theorems and forking are common
HoTT/Agda–HoTT

- generalized Blakers-Massey (WIP)
- total space of Hopf, 3x3 lemma
- Seifert-van Kampen theorem
- Mayer–Vietoris sequences
- cubical reasoning
- Freudenthal suspension theorem
- Eilenberg-MacLane spaces $K(G,n)$
- ...
Used Features

- MLTT-style logic/programming languages
- inductive-inductive & inductive-recursive
- powerful mixfix parser
- pattern matching
- universe polymorphism
- ...
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Used Automation
- higher-order unification
- literal overloading
- FEW tactics
Higher Inductive Types?

Simulated by **rewriting rules** in HoTT-Agda
Higher Inductive Types?
Simulated by **rewriting rules** in HoTT-Agda

```agda
postulate
  S¹ : Type₀
  base : S¹
  loop : base == base

module S¹Elim {l}{P : S¹ → Type l}
  (base* : P base) (loop* : base* == base* [ P ⊲ loop ])
where

  postulate
    f : Π S¹ P
    base-β : f base ↦ base*
    {¬# REWRITE base-β #¬}

  postulate
    loop-β : apd f loop == loop*
```

* effectively the same as Dan's trick
Semantics of Agda
- NOT well-understood (as a whole)
- Many individual features proved
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Mode of Usage
- Highly experimental
Structures and Stats

core/ [10520 code + 1024 comments]
  basic synthetic homotopy theory

theorems/ [16107 code + 1577 comments]
  interesting results

continuous integration through travis
the entire codebase can be checked in 20-30 mins