Isabelle Tutorial:

Truths, Proofs, and Tools

(and how to develop all that correctly ...)

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The ITP Research Programme and The Evolution of the Isabelle/Architecture

The "Interactive Proof" Research Programme

- 1968 : Automath
- 1975 : Stanford LCF
  LISP based Goal-Stack, orientation vs. functional Programming, Invention: Parametric Polymorphism
- 1979 : Edinburgh LCF
- 1984/5 : Cambridge LCF: core LCF principles (1) an abstract type of theorems a (2) tactics that deliver a validation in the form of a function from a theorem list to a theorem.

Historic Overviews:

http://www.cambridge.org/catalogue/catalogue.asp?ISBN=9780521395601
http://www.cl.cam.ac.uk/~mjcg/papers/HolHistory.pdf

The "Interactive Proof" Research Programme

- 1986-88 : HOL88, Isabelle, Coq
  Further search to more foundational and logically safe systems lead to abandon of LCF; HOL became replacement.
  - Invention: Basic Embedding Techniques
  - Invention: Coq: Dependent types, proofobjects
  - Invention: HOL: recursion embeddable, datatype packages, semantics & conservativity
  - Invention: Isabelle: Meta-Logic, tactics as relations over thm's, Meta-Variables, HO Unification, explicit global context (thy's) in thm's and goal's ...

The "Interactive Proof" Research Programme

- 1990-95 : HOL88, HOL4, Isabelle, Coq,
  Maturing of "classic style",
  search for more automation
  - Invention: Coq: Powerful Module Systems
  - Invention: HOL: executable "formulas"
    meson-tac, embedding CSP with FP
  - Invention: Isabelle: LF, Cube, FOL, ZF, (HOL)
    higher-order rewriter,
    tableaux prover blast (98 ?)

The "Interactive Proof" Research Programme

- 1995-00 : HOL4, Isabelle, Coq, HOL-light
  Back to more basics again ...
  and more power and framework, too

- Invention: Isabelle: Class-type System,

  proof objects (Isabelle 96 Workshop !!!)
  auto (combined reasoners)

- Invention: Isabelle:

  embedding HOLCF,
  HOL definitively superseded LCF.
  ProofGeneral.

The "Interactive Proof" Research Programme

- 2000-05 : Isabelle, HOL-light

  Back to more basics again ...
  and more power and framework, too

- Invention: HOL-Light

  Real-number theories & IEEE754,
  Groebner Basis tactics, ...

- Invention: Isabelle:

  ISAR-engine, Proof Documents
  context (state) replaces "theory"
  integration of ATP via Proof Objects

The "Interactive Proof" Research Programme

- 2005-10 : Isabelle, HOL-light

  Back to more basics again ...

  and more power and framework, too

- Invention: HOL-Light

  Formal Verification of Kernel (without Conservativity)

- Invention: Isabelle: Tools:

  Simpl, HOLCF, HOL-Z,

  TestGen, HOL-OCL, HOL-Boogie,