Defining a Niche for HOL4

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Outline

1. State of Play
2. Why Keep Going?
3. If We Do, Where Do We Go?

Context

The world has many interactive theorem-proving systems.

Coq and Isabelle (at least) have larger user bases.

Big systems get more developer love:

- HOL4 needs to “choose its battles”

Strengths (Inherent)

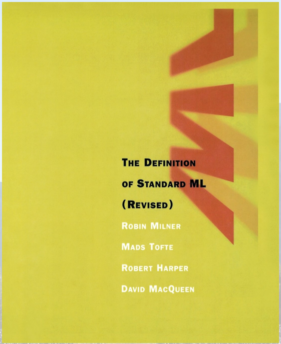
- SML
- HOL
- Persistence Model
- Tools à la Unix?
- ?

[Lake Kananaskis by `davebloggs007@hotmail.com` *via* Flickr]

SML as a Strength

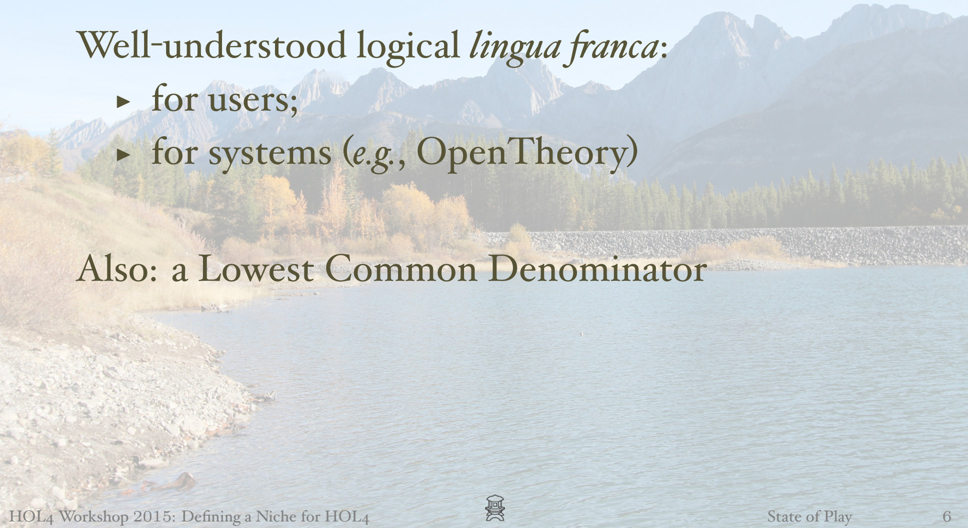
Well-defined language.

Clean semantics.



Has the features the implementor wants:

- type system
- exceptions
- even concurrency (in Poly/ML)



HOL as a Strength

Well-understood logical *lingua franca*:

- for users;
- for systems (*e.g.*, OpenTheory)

Also: a Lowest Common Denominator

Persistence Model

Theories are available on disk in an **implementation-independent** way.

MoscowML and Poly/ML implementations use the same format.

Strengths (Accidental/Historical)

Existing Formalisations

- CakeML, hardware models, ...

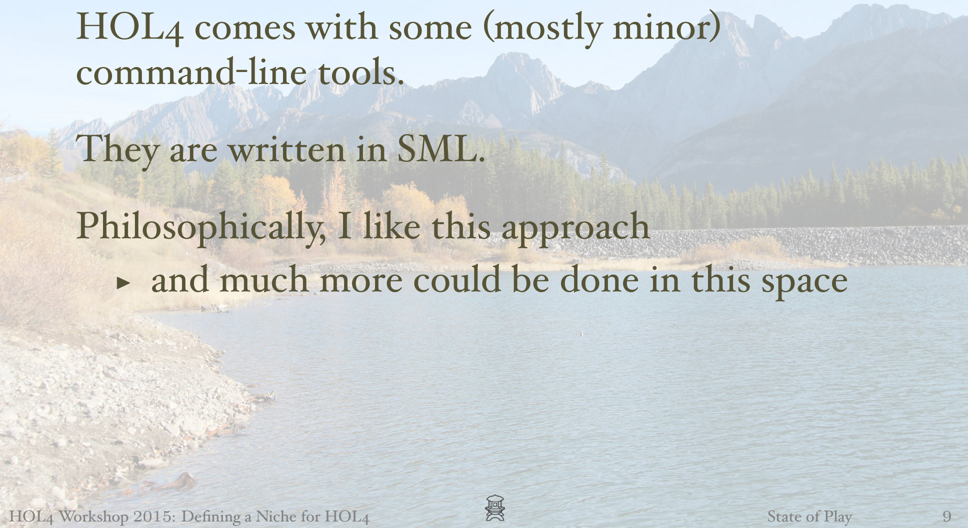
Existing Users

Documentation

Minimal code churn

- caused by slow development...

Unix-style Tools



HOL4 comes with some (mostly minor) command-line tools.

They are written in SML.

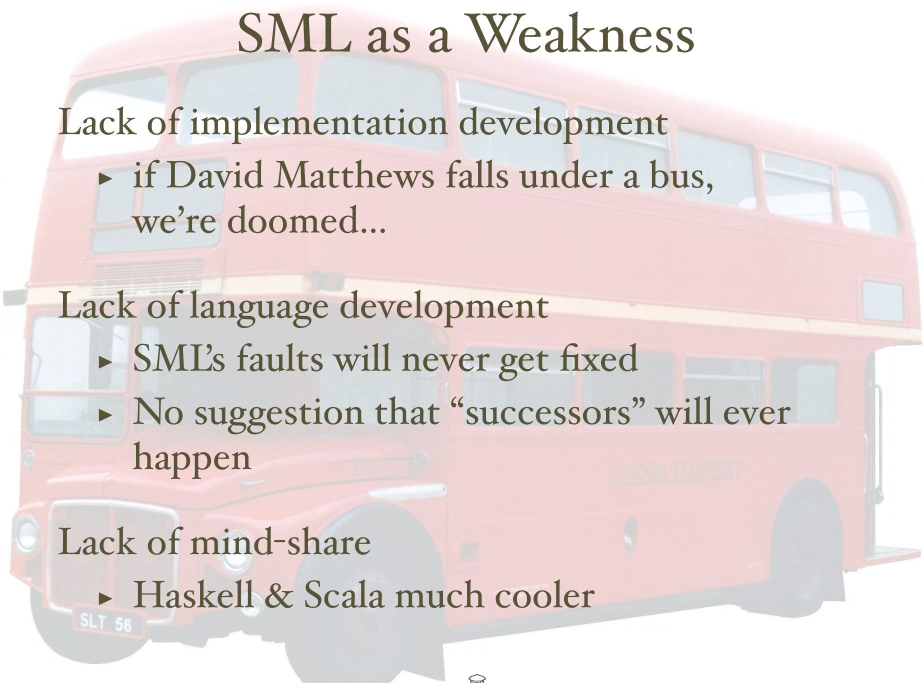
Philosophically, I like this approach

- and much more could be done in this space

Weaknesses

- SML
- HOL
- Windows
- User Interface
- Persistent Theories as Code
- Script-files as Code
- Lack of Concurrency

SML as a Weakness



Lack of implementation development

- if David Matthews falls under a bus, we're doomed...

Lack of language development

- SML's faults will never get fixed
- No suggestion that "successors" will ever happen

Lack of mind-share

- Haskell & Scala much cooler

HOL as a Weakness

HOL doesn't have cool types.

Not even Isabelle/HOL's type-classes.

- And lacking constants with different definitions on different types fundamentally blocks some constructions

User Interface

The `emacs` mode is hobbled by script files as code.

- Some would swear by `emacs` as an IDE
- ...but probably not for SML

Maybe proofs need different editing tools compared to code.

Too Much Code; Not Enough Data

Script files as SML code—yuck.

Theory files as SML code—yuck.

- We were too taken with the idea of getting namespace management from the language implementation
- Script files as data would do away with the need for this "advantage"

HOL on Windows

A sub-par experience:

- Moscow ML is slow
- Without `emacs`, users don't get Unicode

(lack of external dependencies is nice though...)

Why Keep Going?

Selfishness

HOL4 is “owned” by a relatively small group of people.

It is (relatively) easy to push it around according to that group’s taste.

- It’s not even that hard to become an “owner”

So: why give up on a system that can be what *I* want it to be?

One Riposte

Maybe *I* want a system with

- a great UI;
- powerful use of concurrency;
- declarative proof; and
- cutting edge logical tools
  - *e.g.*, powerful datatypes, code evaluation...

Are *you* going to provide all that?

A Scary Alternative

Would the world be better off if:

- we ported all HOL4 work to Isabelle/HOL?

Theorems probably wouldn't be hard to port.

- Large models/definitions may already exist in prover-independent form

Tools would be more of a challenge, but clearly possible in principle.

Dismissing Scary Alternatives

No-one is standing up to do all that work.

HOL4's existing users are probably mostly happy with it as is.

So

Let's Do Nothing (?)

But We Want a System With a Future
(I suppose)

Can HOL4 remain the preserve of a

- small,
- barely self-perpetuating

group of users?

It's harder to share if no-one else is using our tool

Preserve a HOL4 Identity

There is no point in chasing other systems.

Not all vectors of improvement point to positions occupied by existing systems.

If people want to use Isabelle/HOL or Coq, they should.

The Way Forward

- Identify (and then strengthen) the **U**nique **S**elling **P**oints
- Spend development time on important shortcomings
- Support existing users

What *Are* the USPs? (1)

The **HOL4 Tenets of Faith**:

1. Easy to write tools
2. Good documentation
3. Simple system
4. Stable APIs

Development mustn't endanger these.

What *Are* the USPs? (2)

Existing formalisations:

- hardware models
- CakeML
- probability
- ?

Clearly, we must commit to keeping these working

- and ensuring that owners want to keep developing them

Regression test process should help.

Important Shortcomings

Theory Mechanism:

- Theory files on disk should be pure data.
  - allowing manipulation by tools.

Fragile Proofs:

- implement declarative proof language?

Concurrency:

- use Isabelle's PIDE document-centric technology?

Tools:

- datatypes, HOLyHammer, ...?

Conclusion

HOL4 development will continue as long as people indicate they want to keep using the system...

Questions for the Audience

What do you think are the most **important** fixable shortcomings?

- *type abbreviation name spaces?*

What can be done to **improve** community?

- *how might we improve the website?*
- *what big attractive projects might we pursue?*

What **shouldn't** be changed?