Modern ZKP Compiler

Retrospective of chiquito

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Previous PSE zkEVM

I was working on a zkEVM in end 2022 to mid 2023

- Based on halo2, plonkish arithmentization
- With complexity abstraction is inevitable
- Found a treasure trove of abstractions that were build ad-hoc:
- State machines
- Cell manager
- Super circuit / sub circuit

IDEA

Make these abstractions (and more) available to the average developer in an easy interface. This could multiply zkApps development.

Evolution

DSL in rust -> Python front-end -> own parser with similar syntax to circom but with state machines

Features

- State machines are the circuit, the trace is the witness
- Cell manager: abstract plonkish table placement
- Arbitrary boolean expression compilation to polynomial identities
- Common sub-expression elimination using Schwartz–Zippel lemma
- Automatic degree reduction
- Multiple backends: halo2, hyperplonk, sonobe, CCS, pwdr

```
machine fibo(signal n) (signal b: field) {
    // n and be are created automatically as shared
    // signals
    signal a: field, i;

    // there is always a state called initial
    // input signals get binded to the signal
    // in the initial state (first instance)
    state initial {
     signal c;

     i, a, b, c <== 1, 1, 1, 2;

     -> middle {
      i', a', b', n' <== i + 1, b, c, n;
     }
    }

    state middle {
     signal c;

     c <== a + b;

     if i + 1 == n {
      -> final {
       i', b', n' <== i + 1, c, n;
      }
     } else {
      -> middle {
       i', a', b', n' <== i + 1, b, c, n;
      }
     }
    }
```

How it looks like

Feedback from users

- Super easy, new people to ZKP building complex things that were impossible in raw halo2 like blake2f hash
- Efficient!! Same performance for keccak than manual built halo2
- SuperCircuit / SubCircuit is a bad abstraction for composability
- -> Better state machines that call between each other like functions

Sunsetting and current thesis

- zkVMs have become very fast
- zkVMs for new proving systems are easy to build for Risc-V
- Developers will not write circuits, but compile to risc-V and use a zkVM
- Very specialise experts will built fast zkVMs for new proving systems with not much effort
- It is difficult to get adoption for a new language

Thanks team!!

Leo Lara

Edu

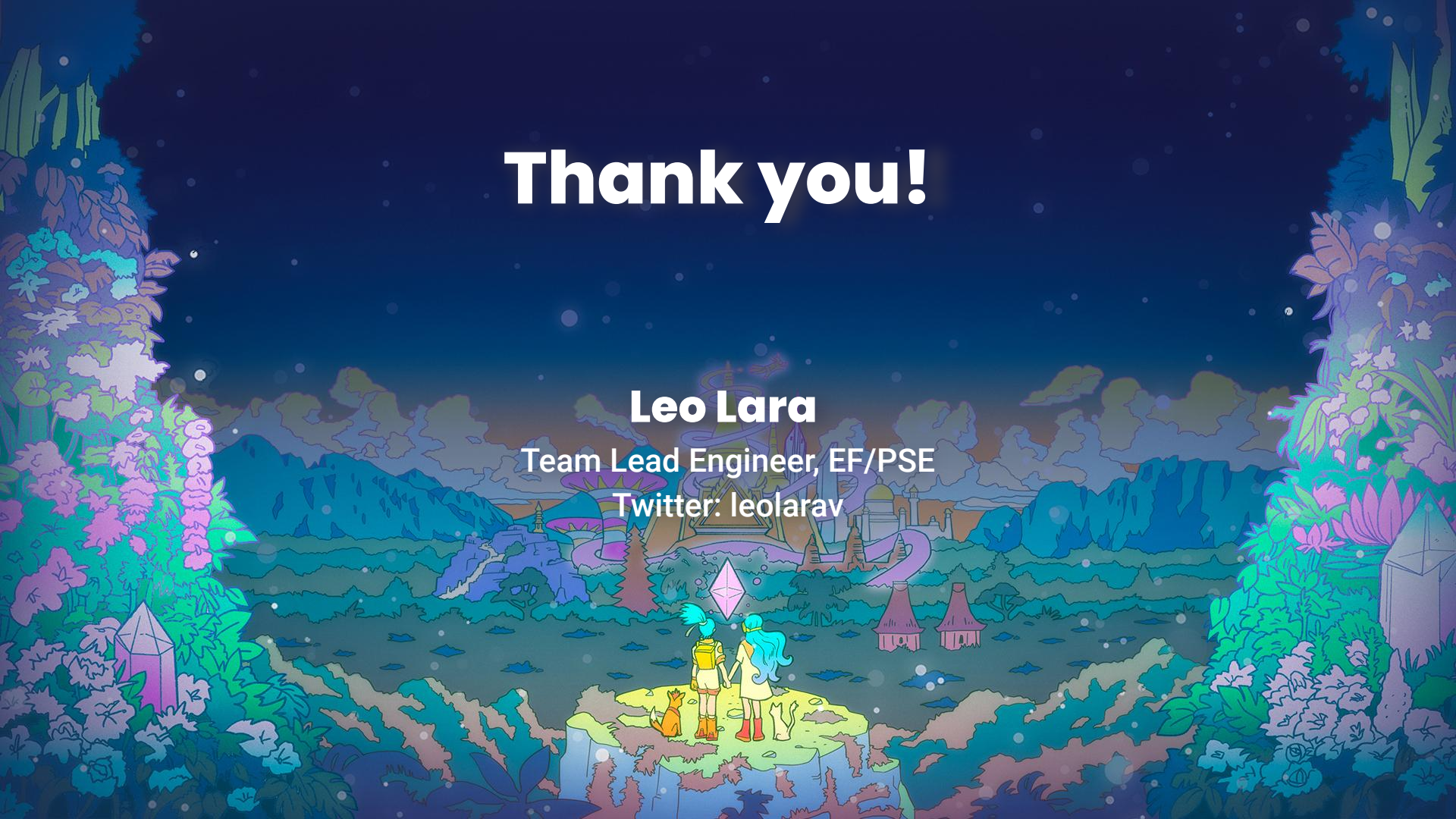
Steve Wang

Even Lu

Rute Figueiredo

Alex Kuzmin

Thank you!



Leo Lara
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Twitter: leolarav

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“Number rules the universe.”

— Pythagoras

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