Timeline
From Invention to Today

- Started RISC-V Project
- Raven-1
  - May 2010
- Raven-2
  - Aug 2011
- Raven-3
  - Feb 2012
  - Jul 2013
- Raven-3.5
  - Apr 2014
- Freedom Everywhere
  - Shipping in 60+ Countries
  - Jul 2015
- RISC-V Foundation
  - Exceeds 100+ Members
  - Aug 2016
- Freedom Unleashed
  - Multicore Linux
  - Oct 2017

- Started Development of RISC-V Core Generator
- EOS14
  - May 2010
- EOS16
  - Jun 2011
- EOS18
  - Sep 2012
- EOS20
  - Mar 2013
- EOS22
  - Jul 2014
- Foundatio
  - n
  - Nov 2015

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SiFive
Global Presence and Reach

SiFive Worldwide Presence
- 10 offices
- 280+ employees
- 300+ tapeouts

World Class Expertise
- Inventors of RISC-V
- PD, RTL, FPGA
- Verification
- Validation

Locations:
- San Mateo, CA
- Boston, MA
- Jerusalem, Israel
- Pune, India
- Bangalore, India
- Shanghai, China
- Yokohama, Japan
- Milpitas, CA
- Austin, TX
- Kaohsiung, Taiwan
The SiFive Management Team combines the inventors of the RISC-V ISA with seasoned industry executives.
Hardware Laws and Consequences

01 Predictable Performance Advances

02 Cost per Computation reduced steadily

03 Low incentive to build custom hardware
Going Over the Edge

Based on SPECIntCPU. Source: John Hennessy and David Patterson, Computer Architecture: A Quantitative Approach, 6/e. 2018
Intelligent Cloud

Going Over the Edge

Intelligent Edge
Going Over the Edge

01 More Custom Compute

02 More Custom Hardware

03 For Custom Workloads and Applications
Challenges of Custom Hardware

Too Expensive and Takes Too Long:

Cost of Developing New Products

```
Feature Dimension (Transistor Count)
```

- 65nm (90 M)
- 45/40nm (130 M)
- 28nm (180 M)
- 20nm (240 M)
- 16/14nm (310 M)

- Validation
- Prototype
- Software
- Physical
- Verification
- Architecture
- IP Qualification

Cost ($M)
Challenges of Custom Hardware

Too Many Experts Needed

14+ Disciplines

- Architect
- Logic
- RTL
- Analog
- Verification
- Simulation
- Emulation
- Synthesis
- Place & Route
- Layout
- ECO
- Foundry
- Package
- Test
How did Instagram turn into a $1B acquisition with only 13 employees?
The Lesson from Software Work at a Higher Level

Software Industry
- Apps
- Java
- Assembly
- Binary

Semiconductor Industry
- Verilog
- GDSII

Semiconductor Revolution
- System Products
- Chisel
- Verilog
- GDSII

Raise the level of Engineering Focus
Hardware Design Layers

- Customer IP
- Vertical Stack IP

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SiFive Designer
IP Customization and Push-Button Configuration
Freedom Unleashed 64-bit Multi-Core RISC-V Linux Platform

1.5+ GHz U54-MC SiFive CPU
- 1x E51: 16KB L1I$, 8KB DTIM with ECC support
- 4x U54: 32KB L1I$, 32KB L1D$ with ECC support
- Single- and Double-precision floating-point support
- 2MB Banked L2$ with directory-based cache-coherence & ECC support

ChipLink
- Serialized Chip-to-Chip
- Coherent TileLink Interconnect

DDR3/4, GbE, Peripherals

Freedom U540, FCBGA, manufactured in TSMC 28nm
Benefits

- Reduced Prototyping Costs
- More Design Starts
- More IP Providers
- More Customization
- More Startups

- Reduced Level of Expertise
- Bring Excitement
- Democratize Access
- Focus on Creating Value
- Help Create a Trillion Dollar Industry