

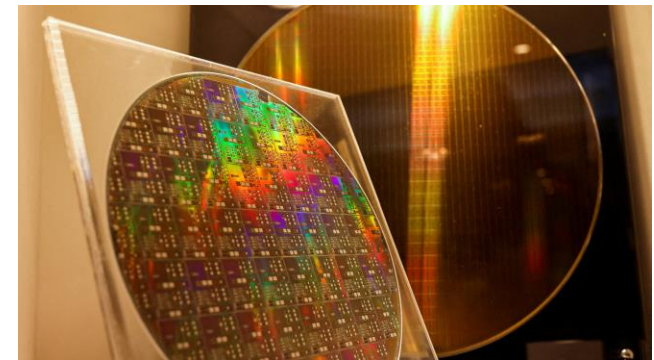
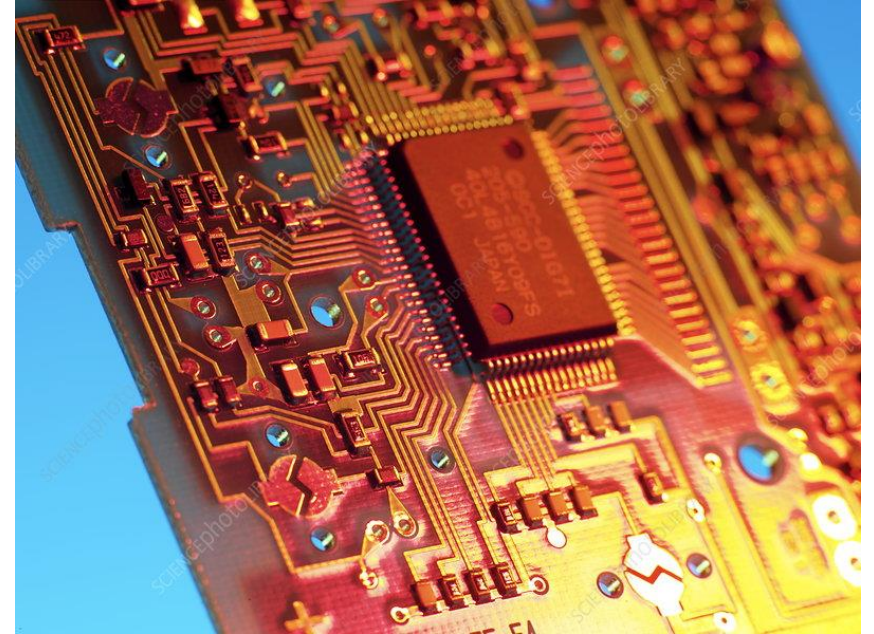


Digital ASIC Problems and Users

CAMDEN FERGEN, JOHN HUARACHA, NICHOLAS
LYNCH, CALVIN SMITH, LEVI WENCK

Digital ASIC fabrication

- Develop an ASIC (Application Specific Integrated Circuit) to be fabricated by eFabless in the spring
 - Decide on project idea (Open ended design)
 - Ensure chip is open sourceDigital test design to ensure accuracy
 - Silicon harden to be fabricated by eFabless
 - Submit in April



Current Plan: RISC-V processor with customizable instruction.



- A processor that runs standard RISC-V instructions but can support and run a custom instruction defined by the user.
- The custom instruction will be stored on a FPGA-like structure.
- The user would be able to customize the FPGA to perform any conceivable instruction with-in the bit limits of the FPGA's I/O.
- Would have both professional and education use cases.



Problem Statement

Processors are limited by their defined instruction sets. If you want to perform an operation that is not in the instruction set, you would have to 1. redesign the processor and refabricate it to support that operation (expensive and time-consuming), 2. approximate the operation by using multiple instructions (slow and/or inaccurate), or 3. avoid doing that operation entirely. These options are not acceptable in many situations.



USERS

ChipForge Club Member



Description:

- Students with interest in designing and fabricating ICs.
- Interested in eFabless design process.

Wants:

- An interactable eFabless digital circuit to test and use.
- An eFabless design to help jumpstart their own design.

Hardware Students



Description:

- Students taking classes in computer hardware.
- Designs and tests digital circuits using FPGAs and software like Questasim.

Wants:

- An interactable IC to help learn various topics about hardware.
- A way to test their ideas for instructions on a fabricated processor.

Professors/Professionals



Description:


- Works in research or industry.
- Needs more advanced solutions to solve computational problems.

Wants:

- A product that can provide more options for solving computational problems.
- A processor that can accelerate specific tasks.
- For professors: new ways to teach students hardware engineering



USER NEEDS

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- User-friendly interfaces so students with minimal experience can use it.
 - Support for advanced functionalities so professionals can fully utilize the products capabilities.
 - Comprehensive and easy testing so users can test their design.
 - Use of a standard ISA at the base to be accessible for users.



Conclusion

- Based on our user needs, our projects requirements are the following:
 - Should work as a normal RISC-V processor when provided RISC-V instructions.
 - Should only execute custom instructions when explicitly specified (should not execute when processor is provided standard RISC-V instructions).
 - Should support custom instructions defined by the user with settings to adjust the customizability based on user proficiency.
 - Should provide user with an I/O interface that facilitates the testing of custom instructions.