# ChipShop: A Cloud based GUI for Accelerating SoC Design

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## Abstract

*ChipShop is a cloud-based graphical user interface (GUI) that democratizes system-on-chip (SoC) design by simplifying the configuration and acceleration process on the open-source Chipyard platform. This user-friendly platform enables users to easily configure core types, caches, memory controllers, and other SoC features while supporting FPGA emulation, mapping, and the addition of new intellectual properties (IPs). ChipShop offers automatic blackbox generation and integration for user-provided RTLs, streamlining the design process and reducing errors. The platform also includes real-time collaboration and version control features, making it ideal for large teams working on complex designs. Future plans for ChipShop involve expanding its functionality to support FireSim and Bitstream Generation through free and open-source tools like F4PGA.*

## Introduction

System-on-chip (SoC) design has become an increasingly important aspect of modern electronics, enabling the integration of multiple components, such as processors, memory, and peripherals, on a single chip. This integration not only improves performance and power efficiency but also reduces the overall size and complexity of electronic systems. However, traditional SoC design has been a complex and time-consuming process that requires significant technical expertise, limiting its accessibility to a select group of individuals and organizations[1].

Recent advances in SoC design tools and methodologies have begun to address this challenge, paving the way for a more streamlined and accessible approach to SoC generation. One such advance is the open-source Chipyard platform, which simplifies the design process by providing a unified environment for configuring, generating, and simulating SoCs. Nevertheless, the Chipyard platform still requires users to possess a degree of technical expertise in order to effectively navigate and utilize its features.

In response to this need for a more accessible and user-friendly approach, we have developed ChipShop, a web-based graphical user interface (GUI) built on top of Chipyard[2]. ChipShop enables users with varying levels of technical expertise to configure and accelerate the RISC-V[3] based SoC generation process, effectively democratizing access to SoC design. By offering an intuitive interface and simplifying complex design tasks, ChipShop has the potential to revolutionize access to chip design and make it available to a wider range of users.

One of ChipShop's key features is its support for FPGA emulation and mapping, which allows users to quickly test, validate, and optimize their SoC designs. This feature accelerates the design cycle and provides users with the confidence to iterate on their designs, ultimately resulting in more efficient and robust SoC solutions. Additionally, ChipShop supports the addition of new intellectual properties (IPs) to SoC designs, enabling users to easily incorporate new functionality and tailor their designs to specific application requirements.

In this extended abstract, we will provide an overview of the ChipShop platform, detailing its features and capabilities, and discussing its potential impact on the SoC design landscape. Furthermore, we will outline our plans for future development, including the integration of FireSim support for large-scale hardware emulation and Bitstream Generation support through free and open-source tools like F4PGA[4][5].

## ChipShop's Architecture and Key Components

The ChipShop platform is built upon a modular architecture, designed to facilitate ease of use and adaptability. In this section, we will discuss the key components of the platform and how they work together to simplify the SoC design process.

### 1. Web-based Graphical User Interface (GUI):

ChipShop features an intuitive web-based GUI that allows users to interact with the Chipyard platform without needing extensive technical expertise. The GUI presents users with an organized layout of configurable SoC components, enabling them to easily select and modify parameters for core types, caches, memory controllers, interconnects, and accelerators, among others.

### 2. Real Time Collaboration:

ChipShop's real-time collaboration feature is a vital component that enables users to work together on SoC designs effectively and efficiently. By allowing multiple

users to access and modify the same design simultaneously, this feature streamlines the design process and fosters communication and cooperation among team members. Real-time collaboration ensures that all team members stay updated on design changes, reducing the risk of miscommunication and errors. Consequently, this feature accelerates project completion and results in more cohesive and robust SoC designs, catering to the diverse needs of the modern electronics industry.

## 3. FPGA Emulation and Mapping Support:

ChipShop integrates support for FPGA emulation and mapping directly into its GUI, allowing users to test and validate their designs quickly and efficiently. This feature enables users to optimize their SoC designs for FPGA-based implementations, speeding up the design cycle and reducing the risk of errors.

## 4. Intellectual Property (IP) Integration:

ChipShop provides a streamlined process for adding new IPs to SoC designs. Users can expand the address space with new IPs, such as MMIO, and easily incorporate them into their designs. Additionally, the platform offers automatic blackbox generation and integration for RTLs provided by users, further enhancing the design capabilities and simplifying the addition of new functionality.

## 5. Extensibility and Future Development:

ChipShop's modular architecture allows for easy integration of new features and improvements. Future plans for the platform include support for FireSim, an open-source hardware emulation platform that enables large-scale design testing, and Bitstream Generation support through free and open-source tools like F4PGA. These planned enhancements will further expand ChipShop's capabilities and make it even more valuable to the SoC design community.

By combining these key components, ChipShop provides a comprehensive solution for SoC design that is both accessible and powerful, opening up the world of SoC design to a broader range of users and fostering innovation in the field.

## Conclusion and Future Outlook

In conclusion, ChipShop represents a significant advancement in the field of SoC design by providing a user-friendly, cloud-based platform that simplifies the configuration, generation, and validation of SoC designs. By leveraging the power of the open-source Chipyard platform and incorporating innovative features such as FPGA emulation, mapping support, and IP integration, ChipShop has the potential to democratize access to SoC design, making it available to a wider range of users.

Looking towards the future, we plan to continue expanding ChipShop's capabilities in order to better serve the needs of the SoC design community. This includes the integration of FireSim support for large-scale hardware emulation, which will enable users to test their designs in more realistic environments and identify potential bottlenecks and areas for optimization. Additionally, we aim to enhance Bitstream Generation support through the integration of free and open-source tools like F4PGA, further streamlining the design process and making it more accessible to users without extensive technical expertise.

Furthermore, we will continue to explore opportunities for collaboration with other open-source projects and initiatives in the SoC design ecosystem. By fostering a collaborative and open approach to SoC design, we believe that ChipShop can contribute to the development of more efficient, innovative, and accessible solutions in the electronics industry.

Ultimately, our vision for ChipShop is to create a platform that empowers users from diverse backgrounds and skill levels to participate in the SoC design process, driving innovation and helping to shape the future of electronics. With a continued focus on user experience, accessibility, and extensibility, we are confident that ChipShop will play a pivotal role in advancing the state of the art in SoC design.

## References

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