Project Details:

- **Project Name:** Optimal NOC Design
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Brief Summary:

The project focuses on designing an optimal Network on Chip (NOC) for a System on a Chip (SoC), considering traffic patterns between CPU, IO peripherals, and system memory. The goal is to achieve efficient performance in terms of latency and bandwidth while optimizing area and power consumption. A simulator is used to model the system, and the project involves developing algorithms to measure performance metrics and employ Reinforcement Learning (RL) to arrive at the optimal NOC design parameters.

Problem Statement:

The challenge lies in designing a NOC that efficiently routes traffic between components while minimizing latency, maximizing bandwidth, and optimizing buffer occupancy and power consumption. The system's performance is influenced by workload patterns and arbitration mechanisms.

Approach:

The approach involves:

1. Developing efficient pseudocode to measure average latency and bandwidth using simulator output.
2. Designing an RL framework to optimize NOC parameters based on states, actions, and rewards.
3. Implementing a suitable RL algorithm, such as Deep Q-Network (DQN), to learn and adapt NOC parameters dynamically.

Proof of Correctness:

The correctness of the algorithms and designs will be validated through extensive simulation and testing using the provided simulator. Performance metrics such as latency, bandwidth, buffer occupancy, and power consumption will be evaluated against predefined thresholds and requirements.

Complexity Analysis:

The complexity of the algorithms and RL framework will be analyzed in terms of computational complexity, memory usage, and scalability. Efforts will be made to ensure efficient performance and scalability for real-world deployment.

Alternatives Considered:

Alternative designs and approaches will be explored, considering different RL algorithms and parameterization strategies. The suitability of alternative approaches will be evaluated based on their ability to meet performance requirements and adapt to dynamic workload patterns.

References and Appendices:

The project will reference relevant literature on NOC design, RL algorithms, and system simulation methodologies. Any additional supporting materials, such as diagrams, code snippets, or datasets, will be included as appendices to provide comprehensive documentation and context.

Public Datasets:

The project may utilize public datasets for training RL models or validating simulation results. These datasets will be appropriately cited and referenced in the project documentation.