

# A Closed Loop CDC Verification Methodology

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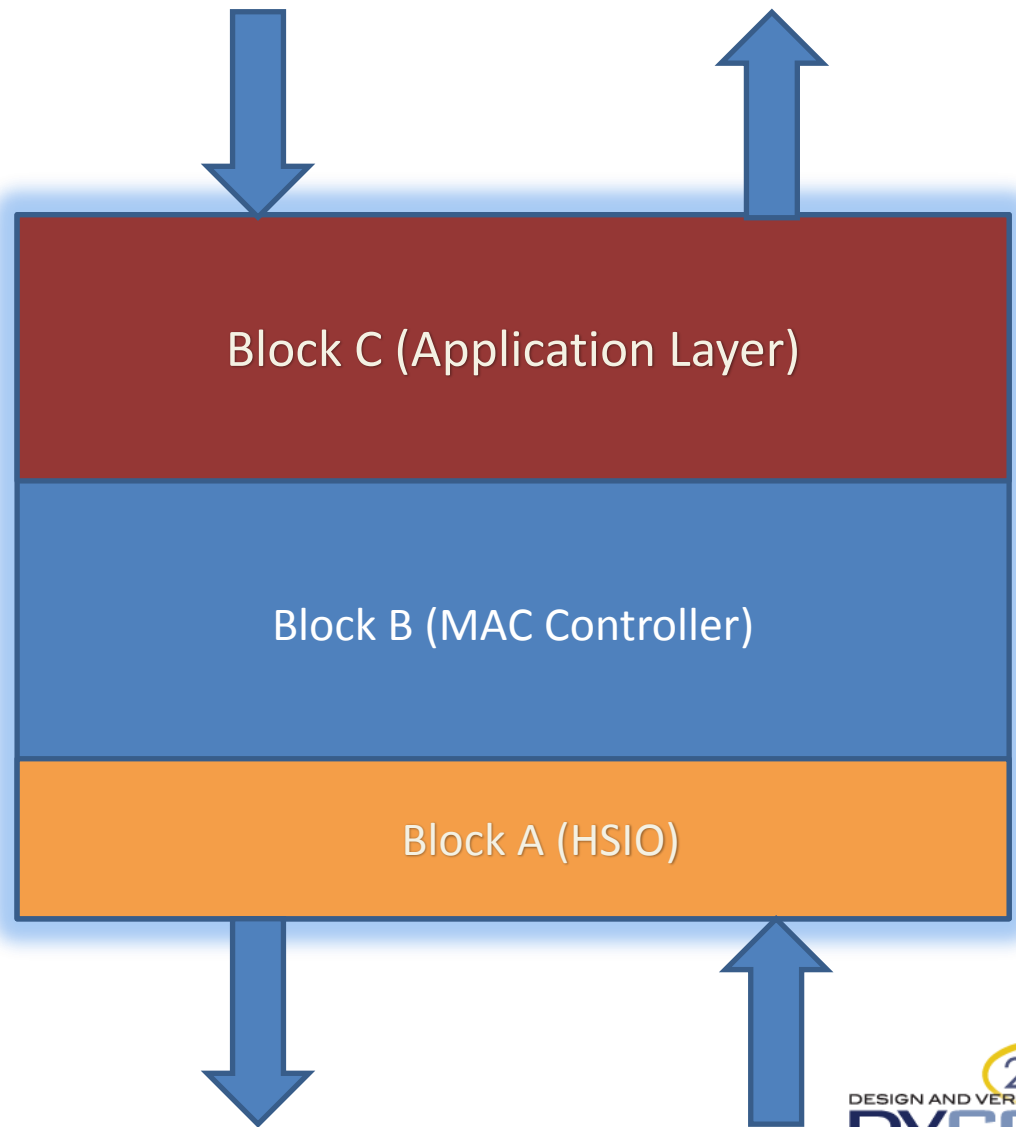


# Agenda

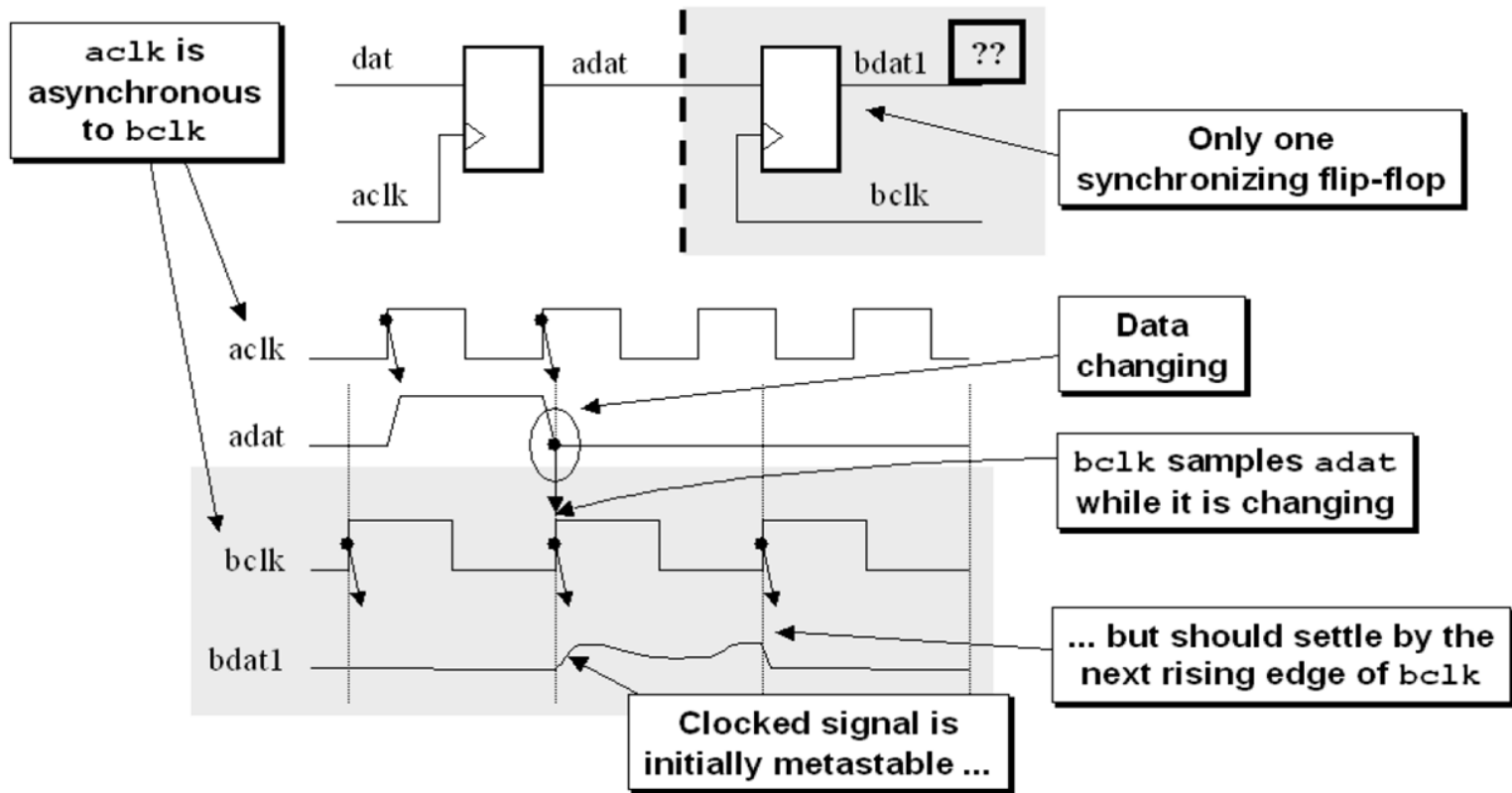
- Introduction
- Standard CDC Methodology
- Standard CDC Results Analysis
- Closed Loop CDC Methodology
- Results
- Conclusions

# Introduction Overview

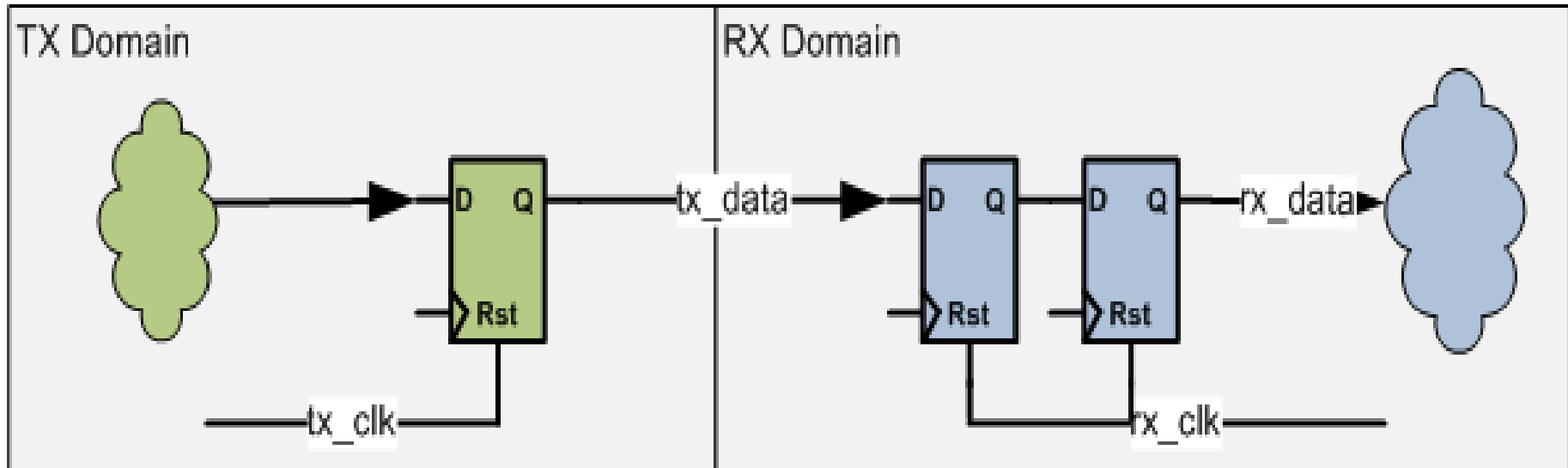
- DUT
  - PCIe 2.0 Endpoint
  - 26 clock domains
  - 1.8M standard cells
  - 1 HSIO Hard macro



# Introduction Metastability

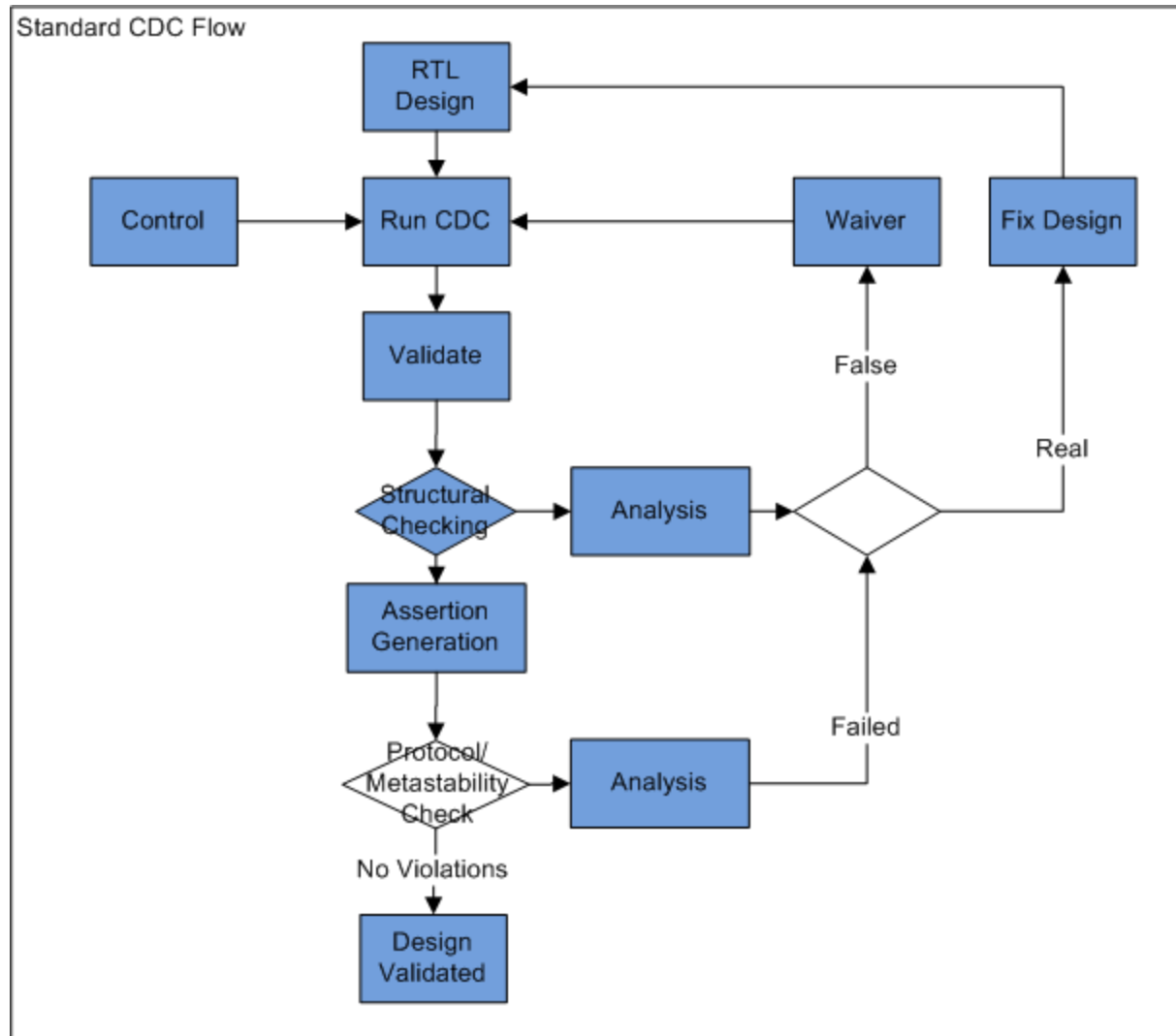


# Introduction Synchronizers



- Designers add synchronizer cells to mitigate metastable signals.
- Synchronizers are library cells that designed to prevent metastable values being sampled

# Standard CDC Methodology



# CDC Methodology Results

- Categories:
  1. Proven
    - Valid CDC paths which can be mapped to a valid CDC scheme
  2. Cautions
    - The CDC path could potentially cause metastability issues and a protocol checker should be used to verify the interface logic
  3. Violations
    - Signals do not adhere to any predefined CDC scheme and require analysis/debug

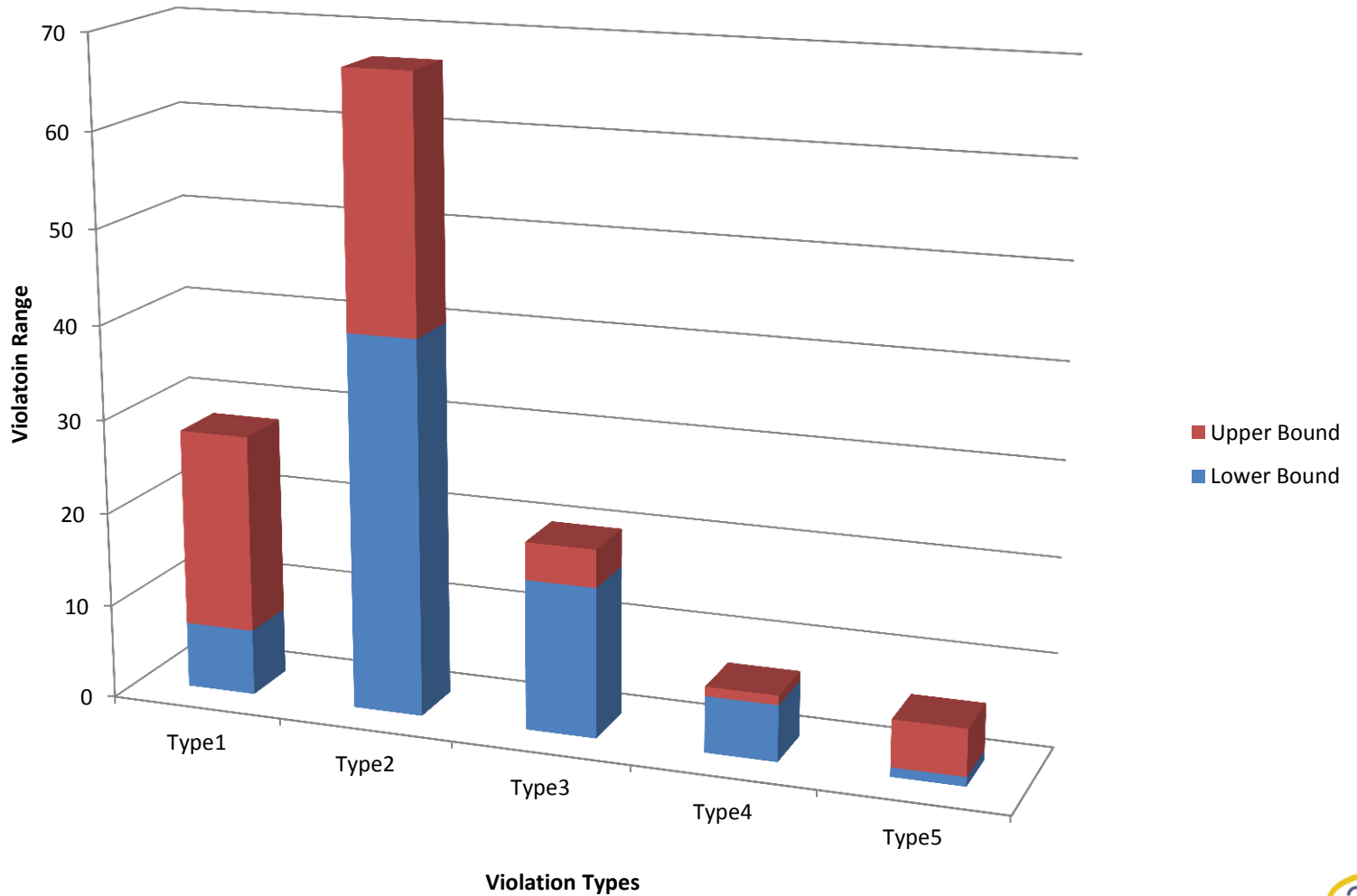
# CDC Methodology Analysis

CDC Violations and Cautions can be categorized into the following types:

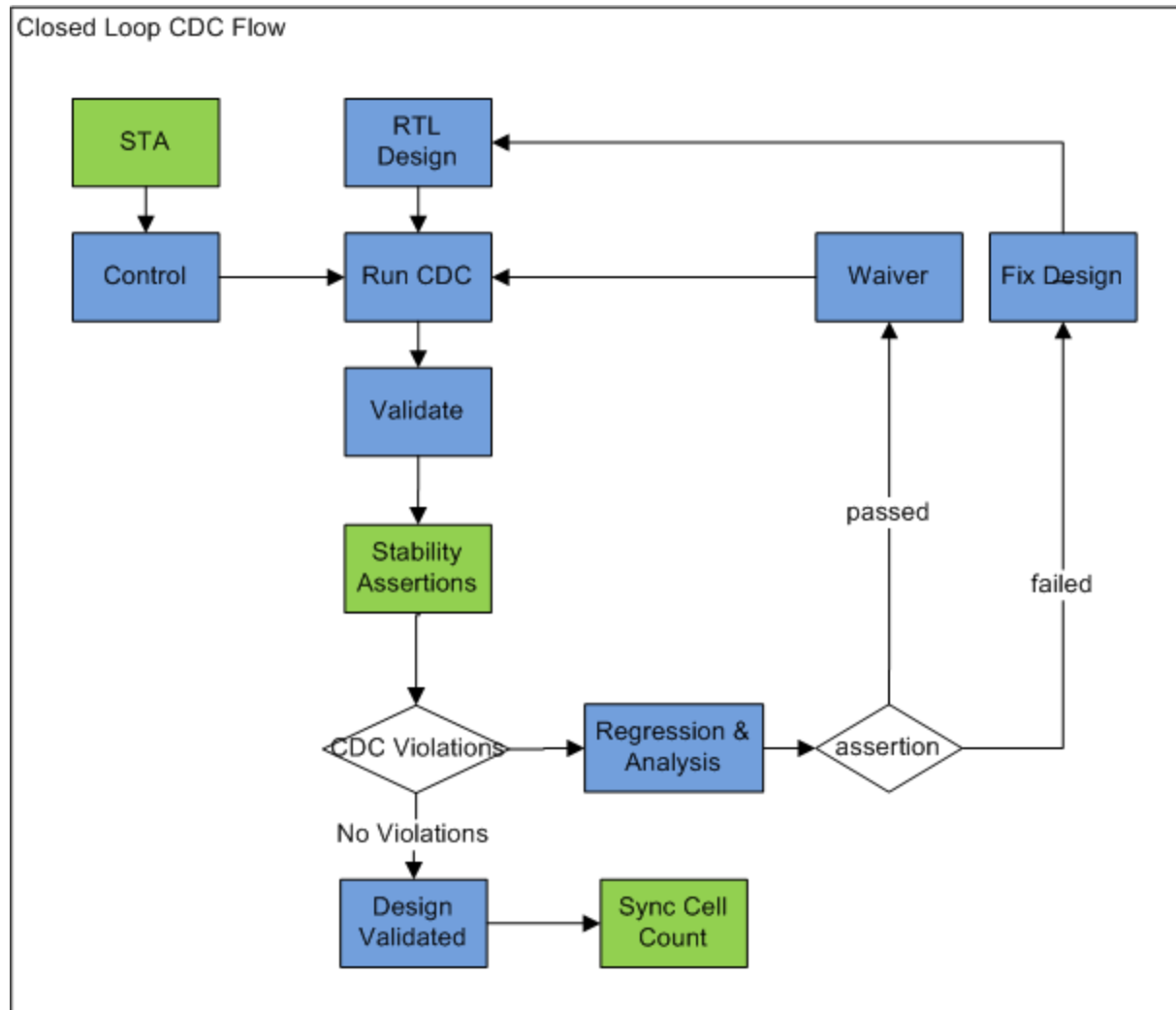
1. Wrong clock specification
2. Quasi-static (stable) signals
3. Dynamic asynchronous Interfaces
4. Non-standard asynchronous design
5. CDC unfriendly designs



# CDC Methodology Analysis



# Closed Loop CDC Methodology

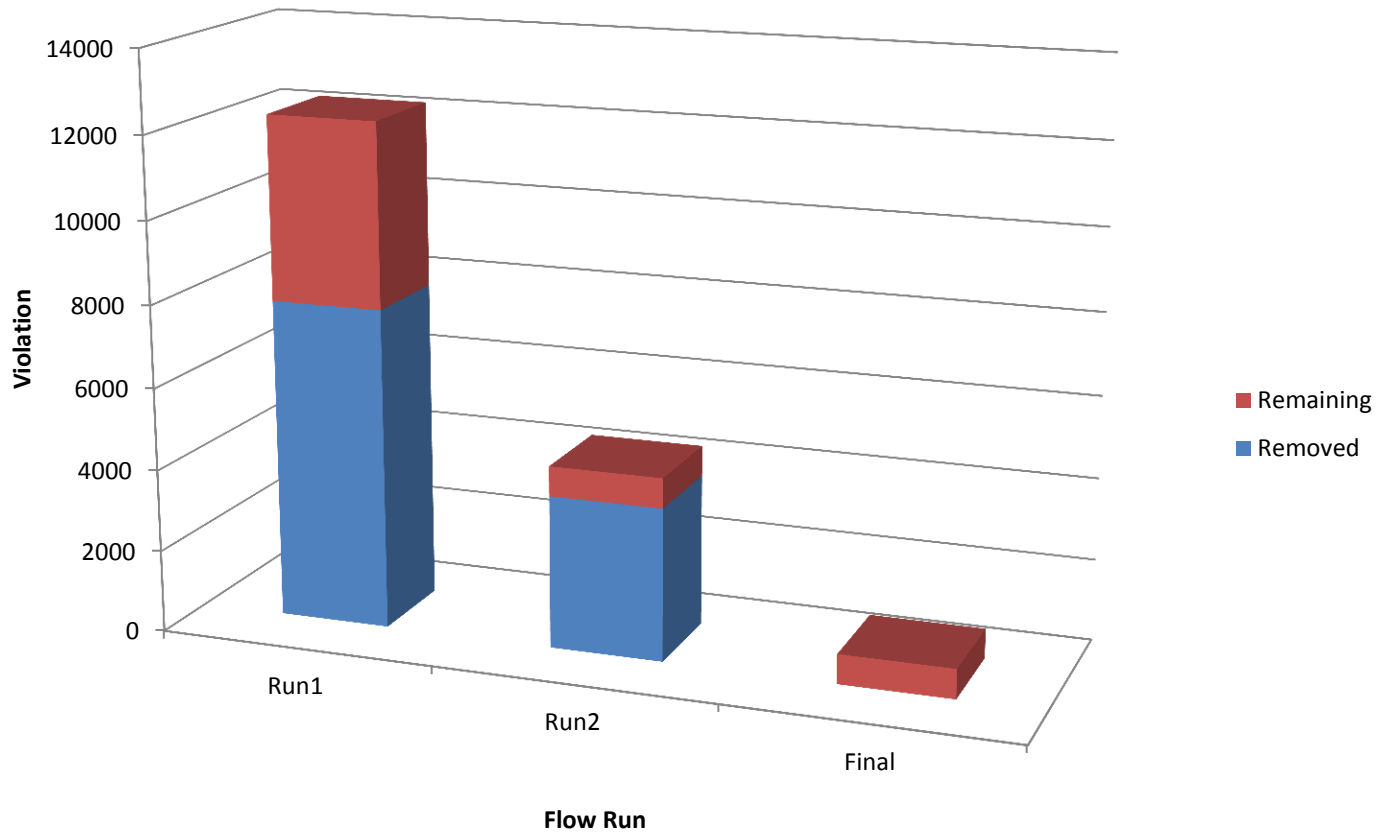


# Closing the Loop

- In order to eliminate all type 1 violations, all IO clocking information is generated from STA sign off tool
  - IO clocking categories:
    - Single Clock Domain
    - Multi Clock Domain
    - Missing clock
- Assertions are generated from CDC violations and simulated
  - Type 2 example assert property (  
    @(posedge TX\_clock)  
    !\$stable(TX\_signal) |-> !config\_phase );
  - All violations with passing assertions are waived.
  - If violation assertions fails in simulation, then further debug is required.

# Closed Loop Results

## Application of Closed Loop updates



# Conclusions

- Accelerates CDC configuration setup
- Automatic waiving and validation of false violations
- Reduces risk of incorrectly waiving a real issue
- Highlights CDC functional validation holes
- Enables Designer to focus on the real violations
- Faster execution time for overall CDC flow

# Questions?