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Clock Sensitivity Test

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EDA Specific Challenges

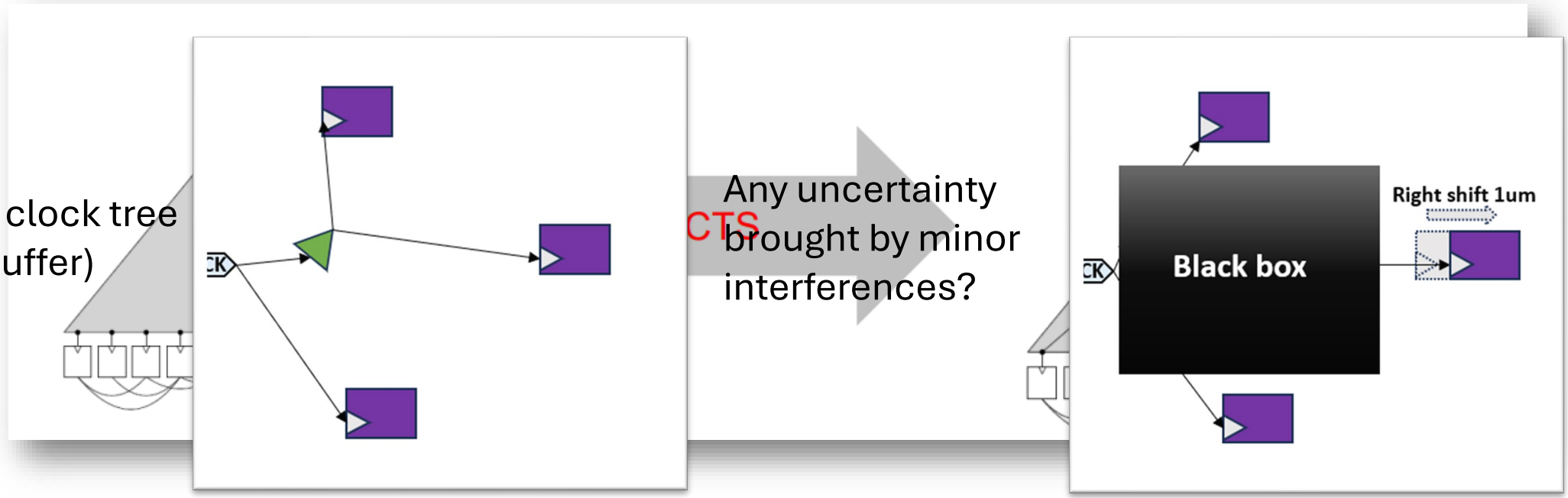
Predicting customer usage is essential, which cannot be accomplished by a single testing scenario.

Customers may encounter **fluctuations in QoR** due to **minor changes** in flow, setting, or design, thereby impacting the release-to-release migration.

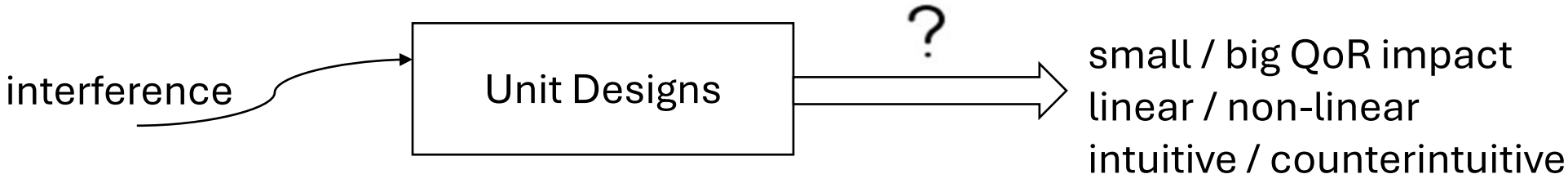
Explore the opportunities from **sensitivity tests** to improve tool quality.

About CTS

Clock tree synthesize + clock tree optimization in the backend flow takes the responsibility to deliver an optimized clock tree solution for **timing-satisfied**, **power/area minimum and latency/skew optimization**.

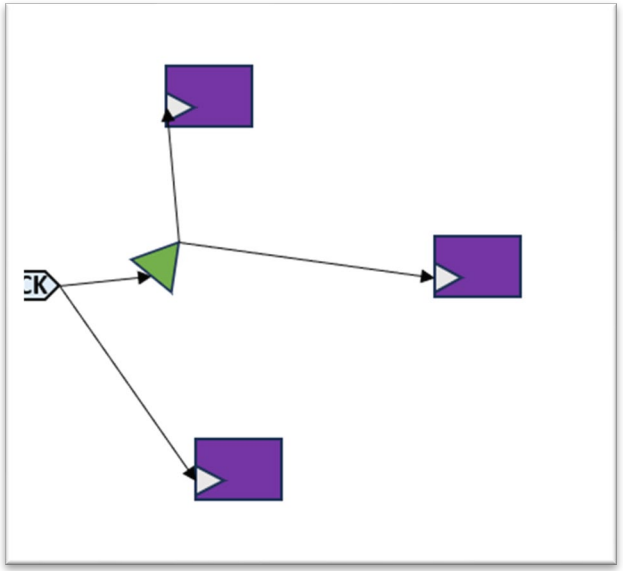


Methodology

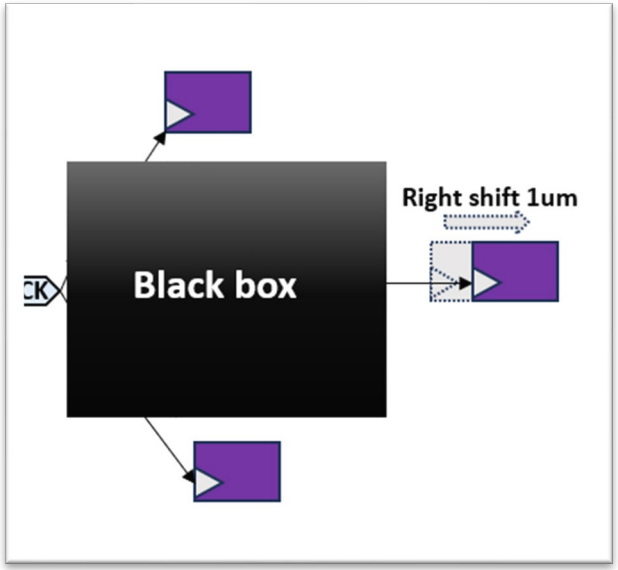


Interference type	Description	Step
Sink location	Shift FF location along x-axis	$[0, \pm1, \pm2, \pm3, \pm5, \pm7, \pm10]$ (um)
Blockage	Add placement blockages	utilization = $[1, 2, 3, 4, 5, 6, 7, 8, 9, 10]\%$
	...	

Original clock tree (green buffer)



Any uncertainty brought by minor interferences?



Implementation

Diversity
N7, N5, N3e, N2…
covering various **tech nodes and benchmarks**

Simplicity
Simple enough to guarantee runtime and debuggability

Sophistication
Complex enough to mimic customer clock scenarios

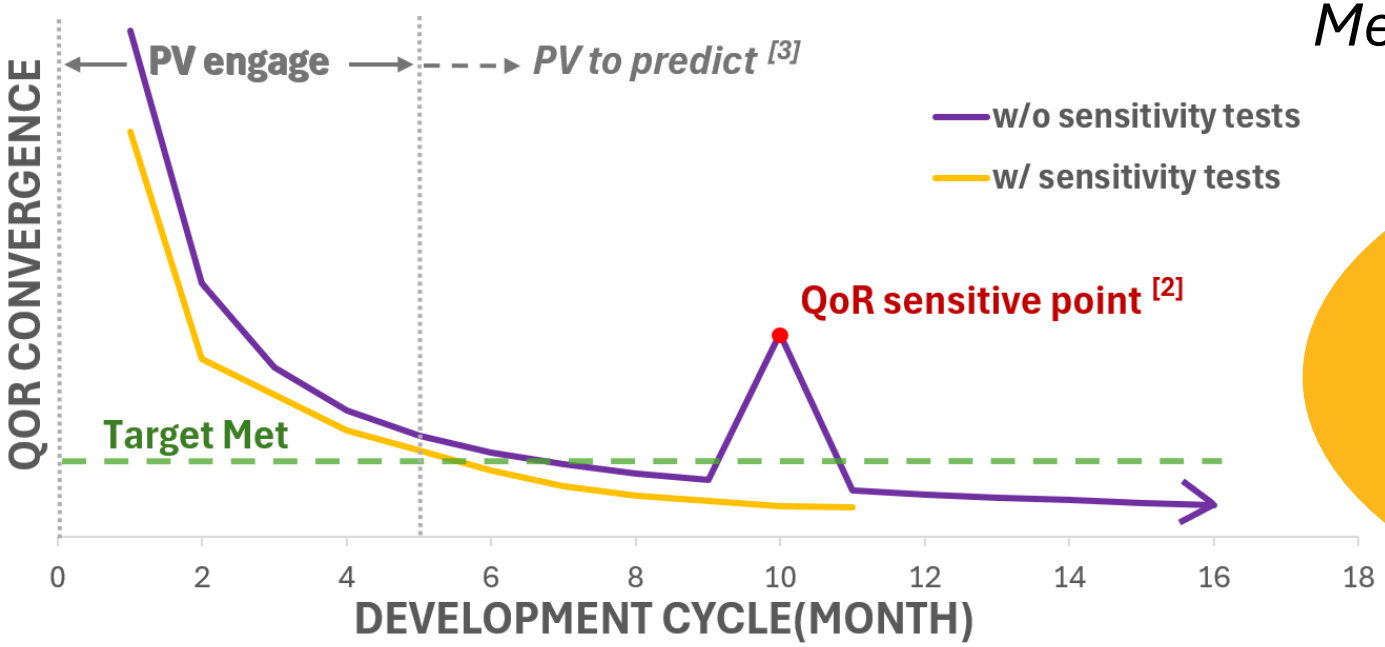
Suite	Design Count	Interferences	Skew Variation Average/Outlier		Latency Variation Average/Outlier	
			Before	After	Before	After
Suite1 (N3E library)	23	Shift FF location	-0.10%/-2.46%	**-0.00%/-0.09%**	-0.36%/-5.28%	**-0.11%/-0.16%**

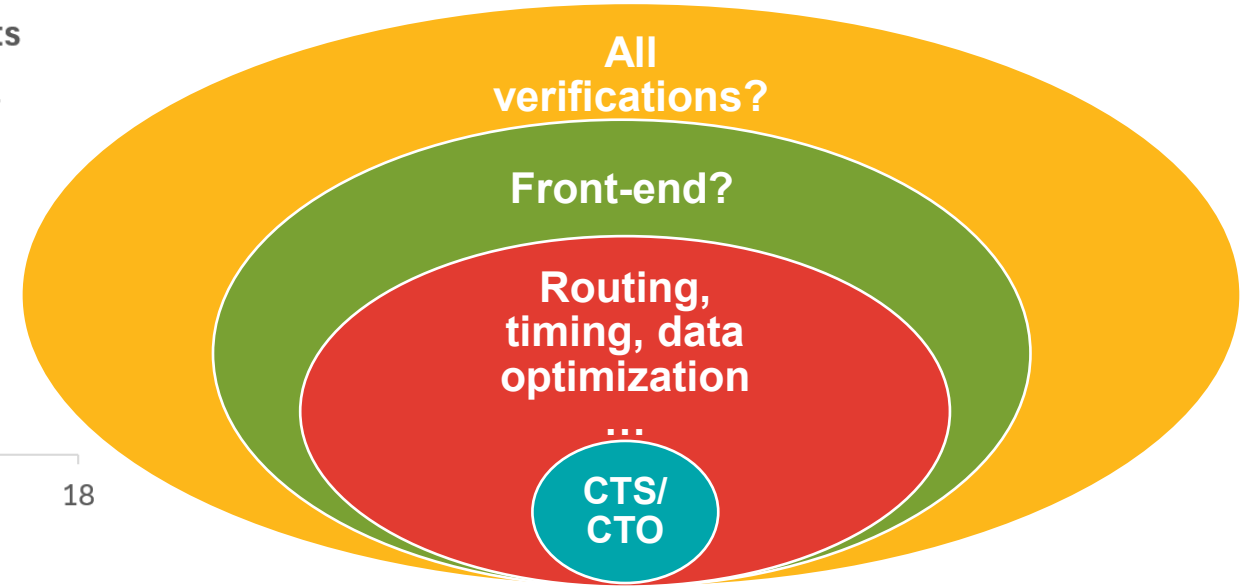
Benefits in Coverage, UX, Quality, Cost

From CTS ... ... to ALL

Scalable Methodology

Methodology can be migrated to any engines





	w/o sensitivity test	w/ sensitivity test
Testing Coverage	Traditional test coverage is **discrete**	Predict **diverse** customer scenarios
User Experience	Minor changes could lead to **large variation**	QoR stays **consistent** facing interferences
Quality	Possibly delivered to customers with **bugs**	Bugs resolved with **priority**
Cost	Debugging is **complicated**	Development cycle is **left-shifted**

Key Takeaways

- Sensitivity tests allows us to explore opportunities to improve tool robustness
  - Reduce variation in engine response to small changes in input stimulus
  - A revolution to break the current “GOLDEN” testing methods

- We start with the CTS engine, and has expanded to other engines

- Welcome your feedback 

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Thank You