# Automated and integrated dynamic voltage drop IR-ECO flow on automotive ADAS SoCs

life.augmented

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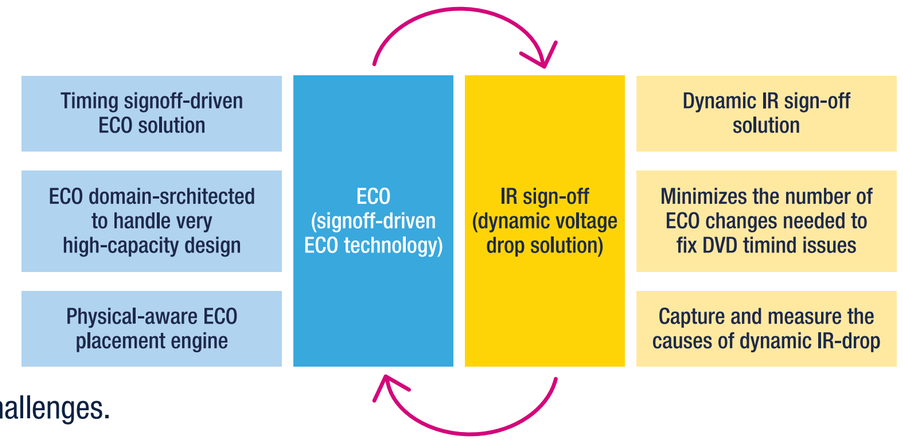
## 1 MOTIVATION

- Challenges of traditional dynamic voltage drop (DVD) IR-ECO sign-off flow:
  - Increasing functionality and design complexity of automotive SOCs has resulted in increasing power grid complexity with high DVD creating significant challenges at lower the technology nodes.
  - DVD leads to change in cell delays resulting in increased setup and hold violations degrading timing QOR.
  - DVD fixes are mostly done manually. These can take several iterations to fix impacting time to market.
  - It is difficult to analyze the root causes of DVD.
  - Conventional DVD and the sign-off STA flows have been mostly disjoint, employing margin-based methodologies that lead to overdesign and suboptimal PPA.
- Solution: Presenting here an automated and integrated DVD IR-ECO flow that effectively addresses above challenges.




Automated IR-ECO flow integrating industry's best sign-off ECO and IR analysis tools

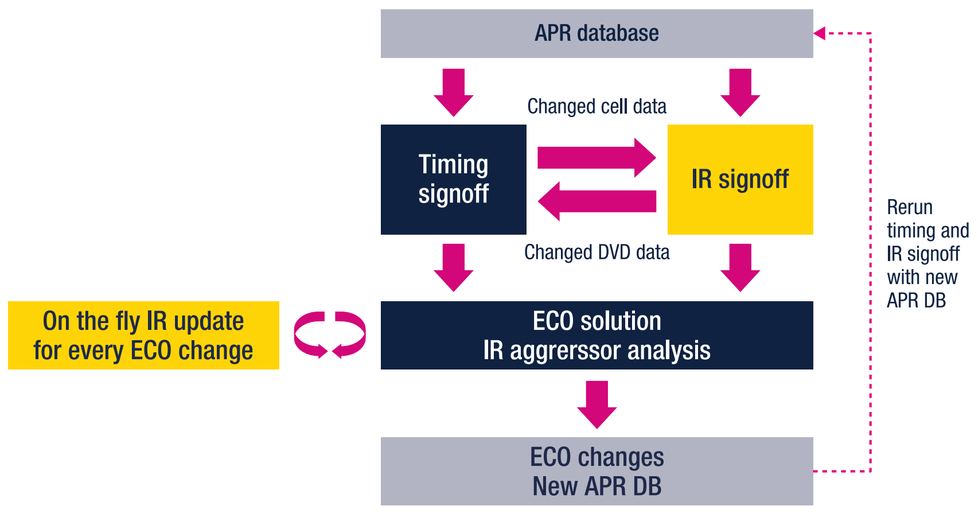
## 2 MAIN IDEA

- Automated signoff-based flow to improve DVD IR violations without impacting timing QOR.
- Timing ECO tool integrates both signoff STA and signoff IR to enable simultaneous voltage and timing fixing in a single platform including fast what-if analysis.
- Using advanced analytics within DVD diagnostics capability in IR signoff tool, identifying and measuring the root cause of DVD caused by the aggressors by analyzing the drop contributions from neighboring aggressors for a given high DVD instance. This significantly reduced the number of DVD fixes required for improvement in IR.
- This automated flow provides interactive and incremental what-if analysis for better and faster PDN convergence.


Simultaneous voltage and timing fixes, more DVD fixes with fewer ECOs for better, faster PDN convergence

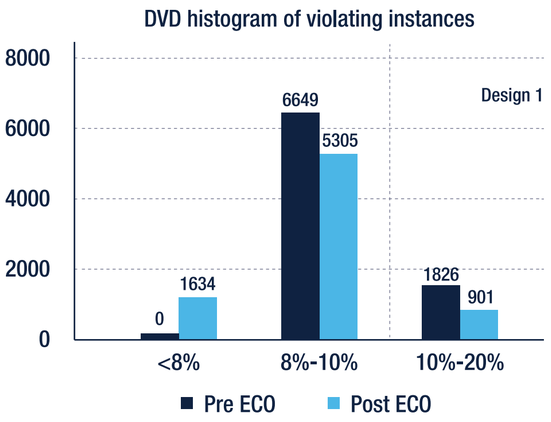
## 3 MAIN IDEA

- The details of the flow steps are as follows:
  1. Analyze DVD and find the root cause of DVD violations
     - Export a list of aggressors and victims
  2. Timing ECO tool reads in DVD and STA database
     - Reads DVD of instances and Aggressor/Victim list
     - Selects ECO candidates
  3. Timing ECO tool and IR signoff tool communicate with each other over on the fly live IR session and perform incremental analysis
     - Timing ECO tool sends potential victims to IR signoff tool
     - IR signoff tool replies aggressors of the victim to timing ECO tool
     - Timing ECO tool creates and sends ECO changes like size cell and move aggressor location.
     - IR signoff tool sends DVD changes for ECO list
  4. Timing ECO tool creates ECO command file and what-if DVD result
  5. ECO command file is executed in P&R tool.



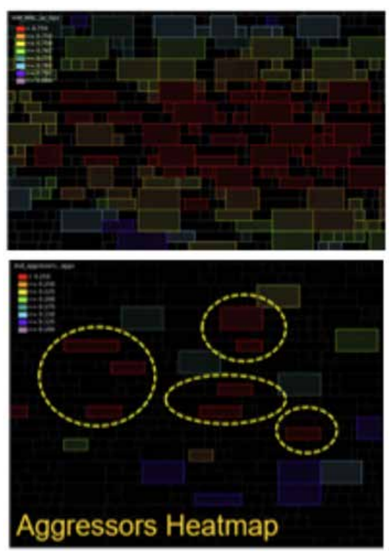

## 4 EVIDENCE

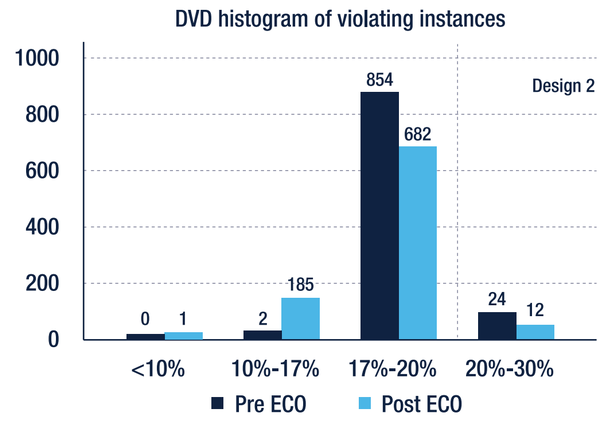
- Results on advanced SoCs using automated DVD ECO flow




| Parameter | Pre ECO | Post ECO |
|---|---|---|
| IR violation count | 1826 | 901 |
| Worst | 16.13% | 15.66% |
| Average | 9.27% | 5.71% |

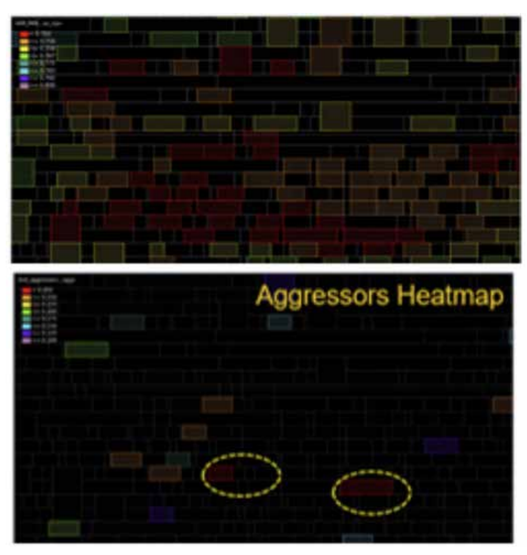
Cell count over DVD criteria decreased from 1826 to 901 (51%)




| Parameter | Pre ECO | Post ECO |
|---|---|---|
| IR violation count | 24 | 12 |
| Worst | 22.07% | 21.3% |
| Average | 17.85% | 17.32% |

Cell count over DVD criteria decreased from 24 to 12 (50%)




## 5 SUMMARY

- The post-ECO results using this automated IR-ECO flow showed a decrease in DVD violation count by 50% on our designs saving turn-around-time.
- The automated analytics-based DVD IR ECO flow minimizes design changes for faster PDN convergence and better PPA without degrading timing.