FC ML/DSO.ai Macro Placement

Hoda Thabet
Senior Staff Engineer
Infineon Technologies

Agenda

Introduction

Introduction

Scope

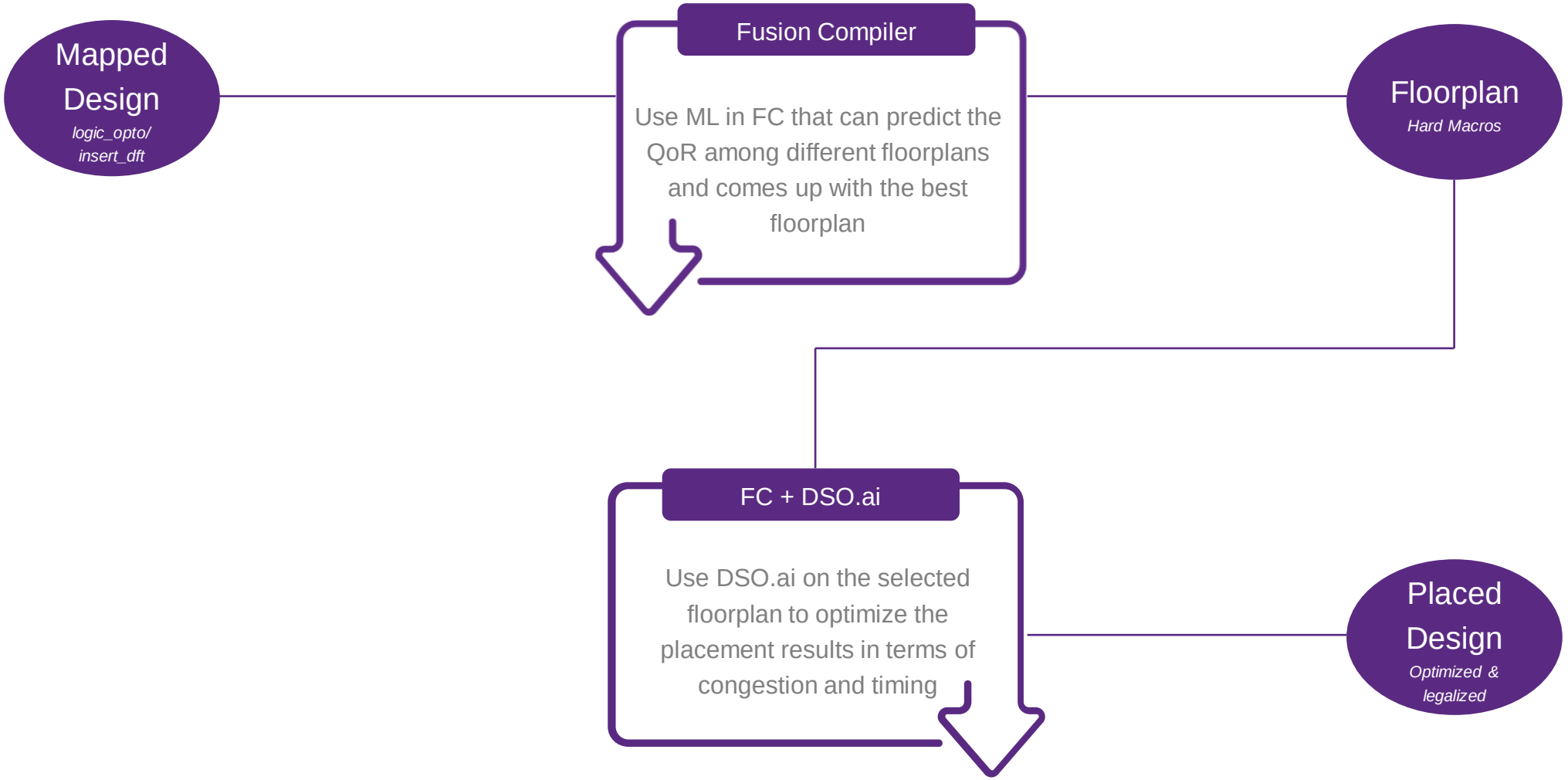
- Evaluate FC ML/DSO.ai for achieving better PPA through exploring ML macro placement capabilities.
- ML auto macro placement creates the best macro placement for congestion, timing, and power.

Motivation

- Floorplan/macro placement have a big impact on PPA.
- It takes up to several months to come up with a floorplan that will provide good PPA.
- Reduce the manual effort and the iterative process to find the best placement solution.

Flow

Flow Overview



FC ML-Based Macro Placement

Fusion Compiler

Use ML in FC that can predict the QoR among different floorplans and comes up with the best floorplan

How

Command

place_macro_ml

explore_macro_placement

Options

Mode : congestion | tns | power | both | wirelength | all

Style : hybrid | on_edge | freeform | auto

Effort : high | medium | low

What Happens

ML Data Creation

User provided ML data
ML data built-in to the tool
ML data on-the-fly from current design

Trained ML Model for congestion/timing/power prediction

Best Floorplan Selected

Outputs

Floorplan

- Saved in the NDM
- FP DEF File
- FP & GRC PNGs

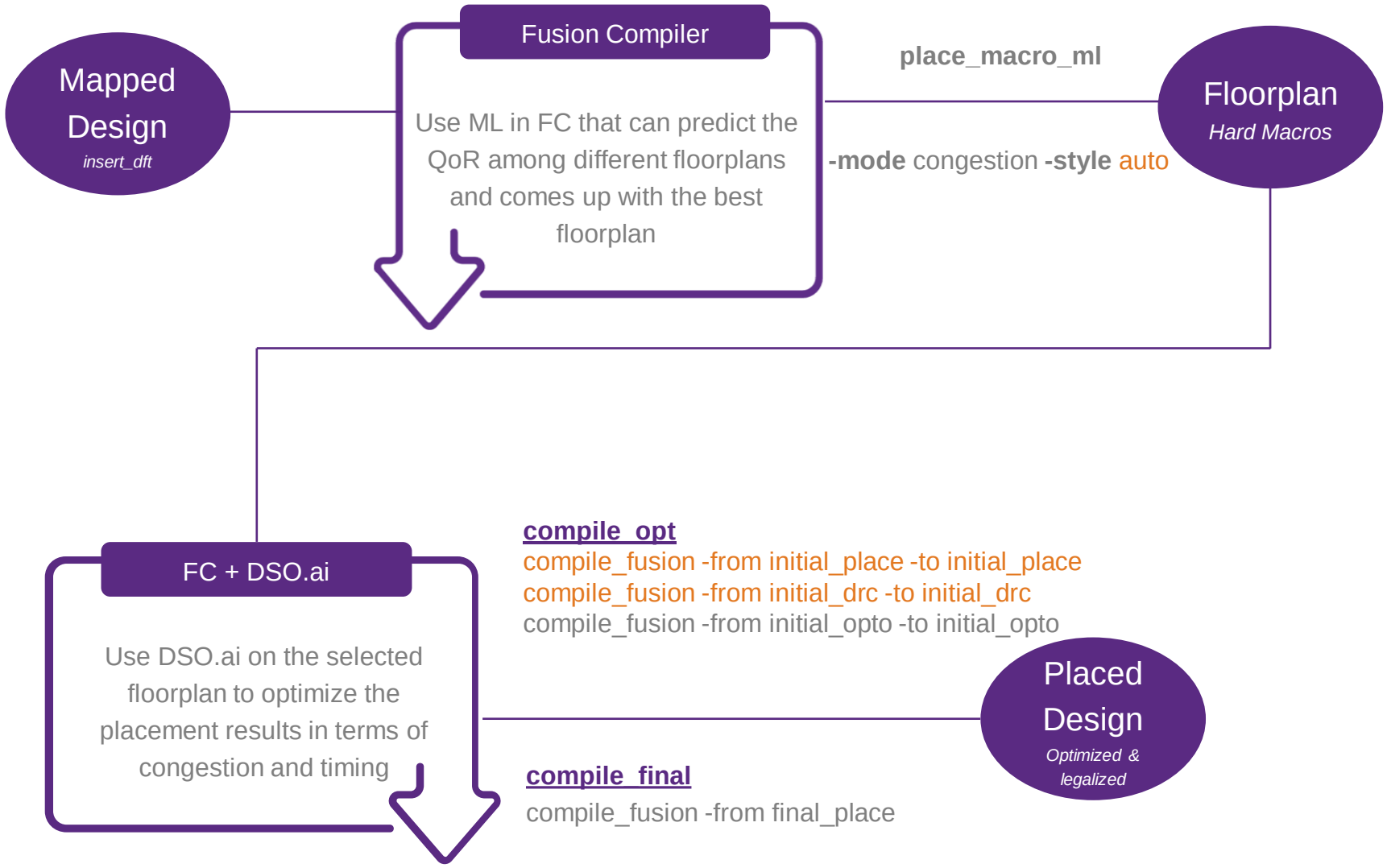
DSO.ai Permutons

- For explore_macro_placement
- Permutons file is encrypted

ML Trained Model Data

- **hm_local.csv file**: Contains multiple ML data. Each ML data corresponds to one explored floorplan
- **hm_local.signature file**: Contains information that the tool uses to decode the ML data

Explored Flow



Testcases

QoR

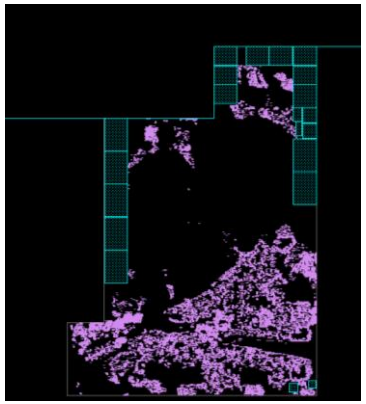
Compared to Original Baseline Floorplan

Run	Overall Improvement	R2R WNS Improvement	R2R TNS Improvement	CONGESTION Improvement
FC ML + DSO.ai *starting initial place*	60%	70%	80%	65%
FC ML + DSO.ai *starting initial opto*	50%	60%	70%	60%

Baseline

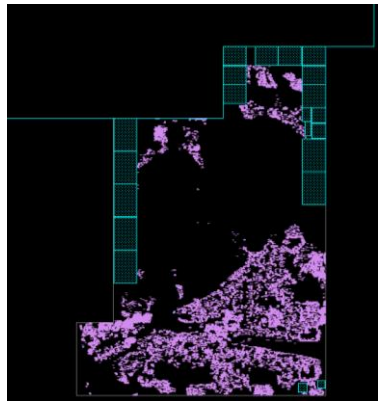
FC ML + DSO.ai

Starting initial_place



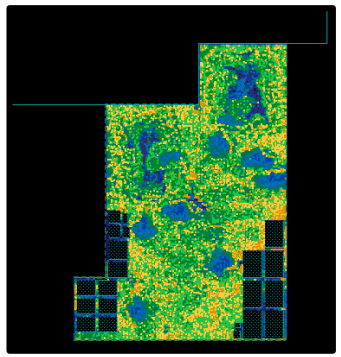
FC ML + DSO.ai

Starting initial_opto



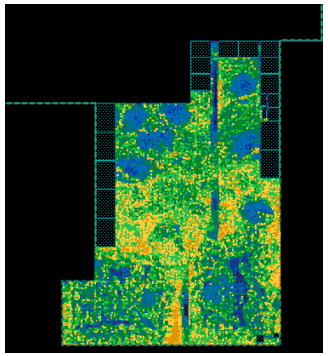
Cell Density Map

Baseline



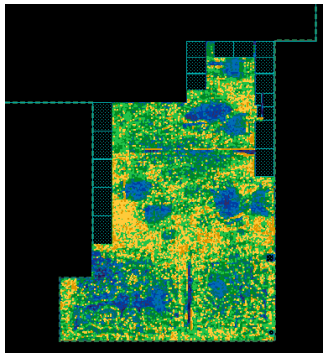
FC ML + DSO.ai

Starting initial_place



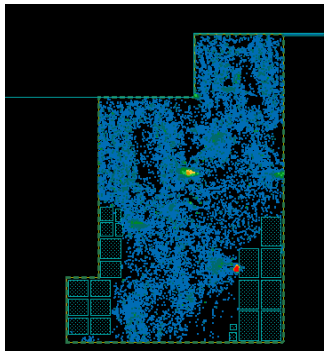
FC ML + DSO.ai

Starting initial_opto



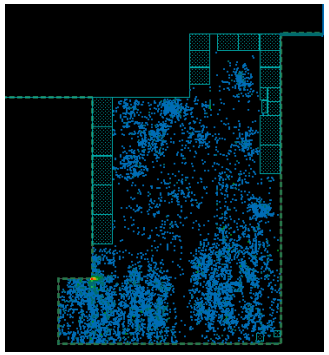
Global Routing Congestion

Baseline



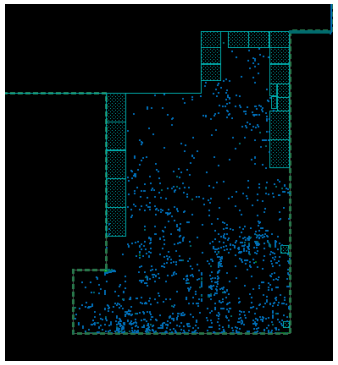
FC ML + DSO.ai

Starting initial_place



FC ML + DSO.ai

Starting initial_opto



Conclusion

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- ML floorplan exploration can be used as a parallel track/guidance on an initial floorplan.
- This guidance can provide a better congestion and timing results after full placement phase.

Next Steps/More Things to Explore

- Run the full flow till route on the ML floorplan to verify that the design is routable.
- Involve DSO.ai in the ML FC floorplanning step to explore other ***mode*** & ***style*** options.


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