Introduction to OpenLane

Workshop Session 2

Presented by
Hafiz Wajeh ul Hasan

https://github.com/merledu
https://www.merledupk.org

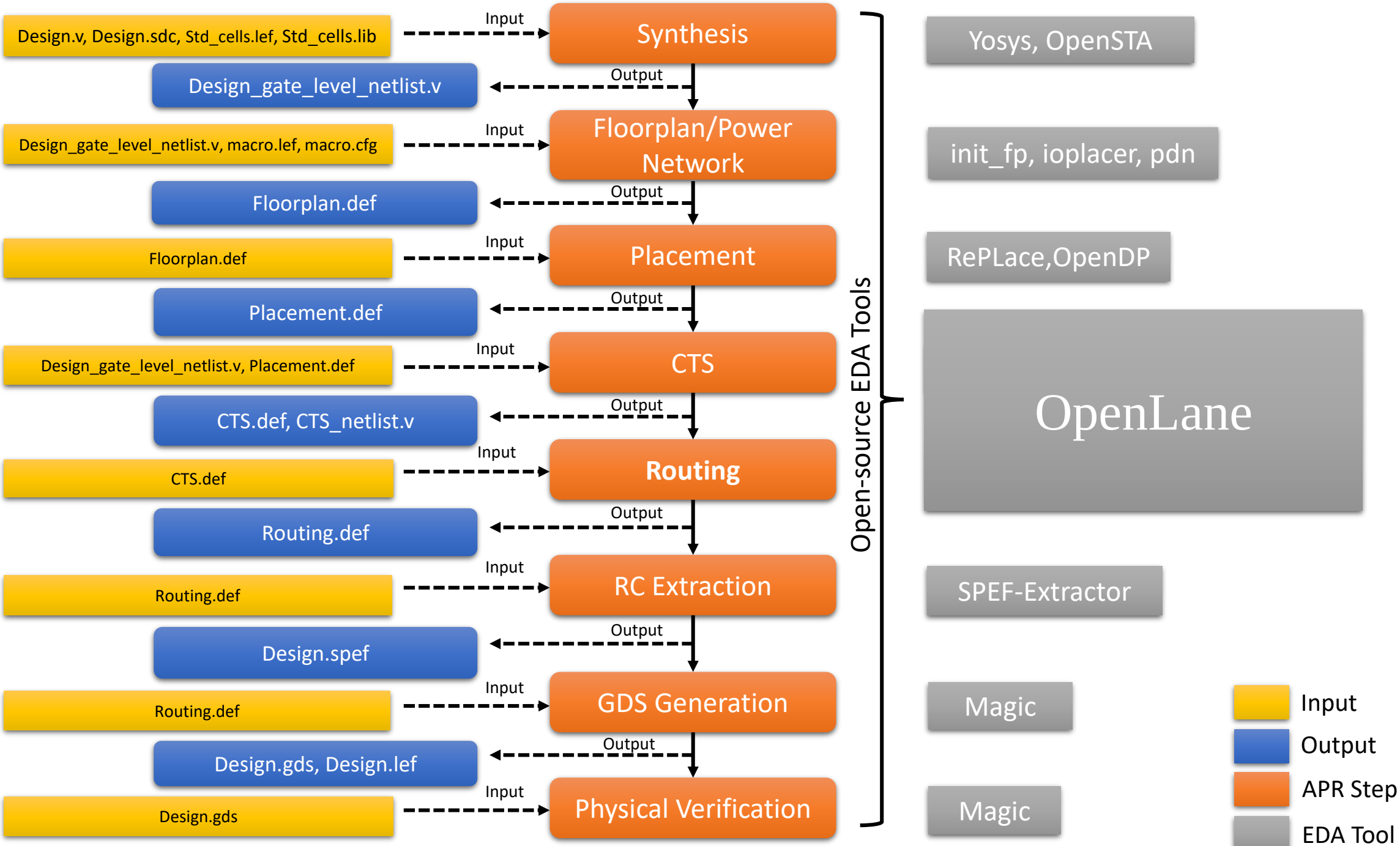
Contents

- OpenLane
- PDK
- Foundry
- Prerequisites for an ASIC Design
- Sky130 PDK

- LAB PRACTICE

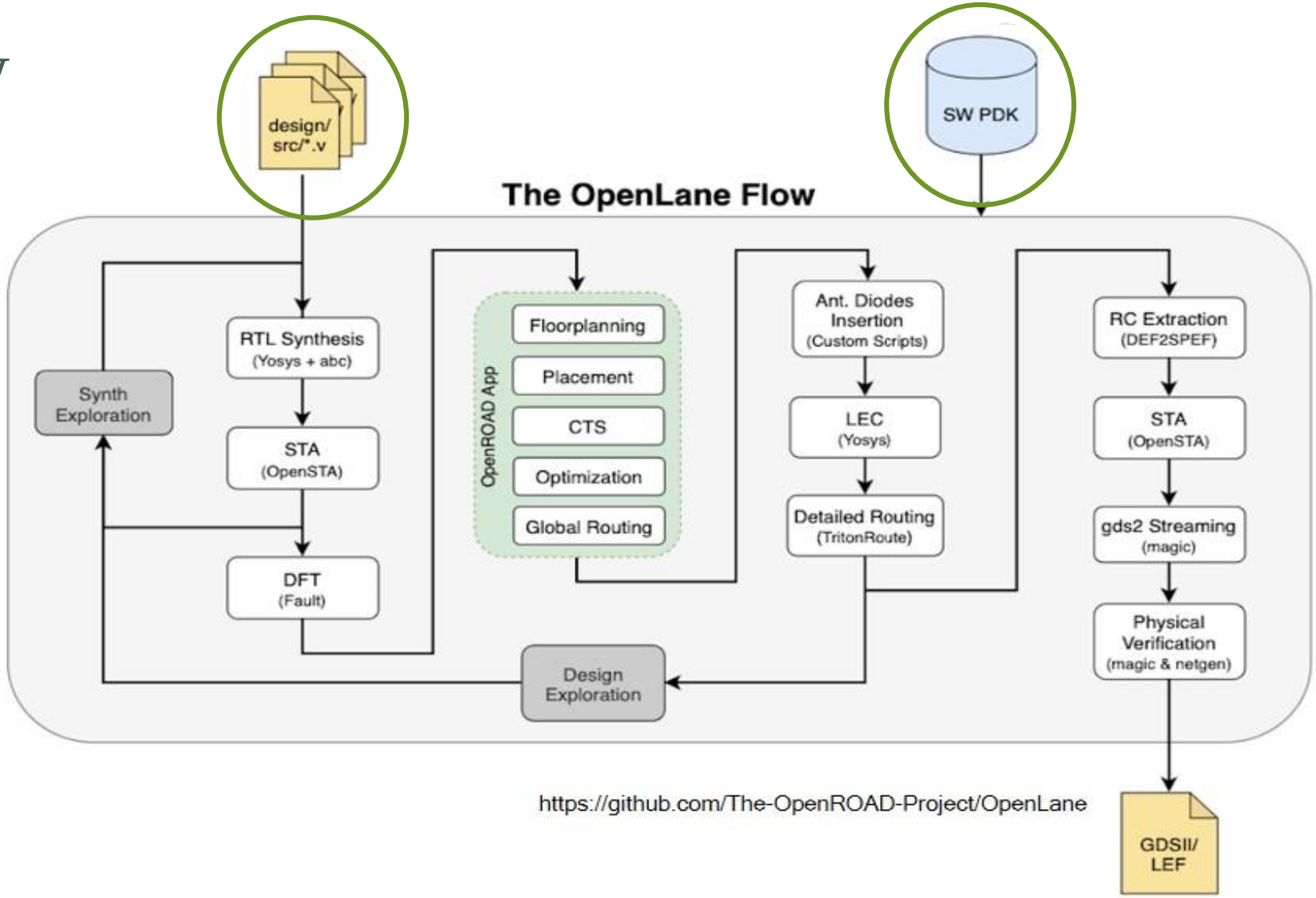
OpenLane

- What is OpenLane?
  - OpenLane is an automated RTL to GDSII flow
  - The flow performs full ASIC implementation steps from RTL all the way down to GDSII
  - Amalgamation of open-source **Electronic design automation** (**EDA**) Tools


Design.v, Design.sdc, Std_cells.lef, Std_cells.lib
Input
Synthesis
Output
Design_gate_level_netlist.v
Design_gate_level_netlist.v, macro.lef, macro.cfg
Input
Floorplan/Power Network
Output
Floorplan.def
Floorplan.def
Input
Placement
Output
Placement.def
Design_gate_level_netlist.v, Placement.def
Input
CTS
Output
CTS.def, CTS_netlist.v
CTS.def
Input
Routing
Output
Routing.def
Routing.def
Input
RC Extraction
Output
Design.spef
Routing.def
Input
GDS Generation
Output
Design.gds, Design.lef
Design.gds
Input
Physical Verification
Open-source EDA Tools
Yosys, OpenSTA
init_fp, ioplacer, pdn
RePLace,OpenDP
OpenLane
SPEF-Extractor
Magic
Magic
Input
Output
APR Step
EDA Tool

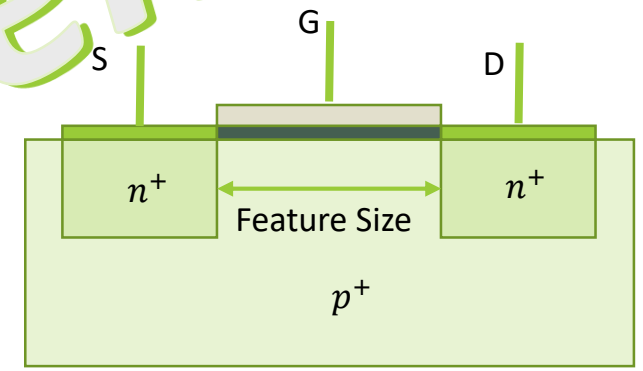
OpenLane Flow

- The inputs of the flow?
  - Design.v/RTL
  - PDK
- What is a PDK?



PDK (Process Design Kit)

- It's a set of libraries and associated data to design in a particular technology
- Simpler terms- A PDK contains:
  - Transistors
  - Standard Cells (for digital design)
  - Design Rules
  - Timing/Power Information etc. in library file
  - Layer information



- Technology
  - 130nm
  - 90nm
  - 65nm
  - 45nm
  - 30nm

Feature Size

Foundry

- Who provides the PDK?
  - FOUNDRY!

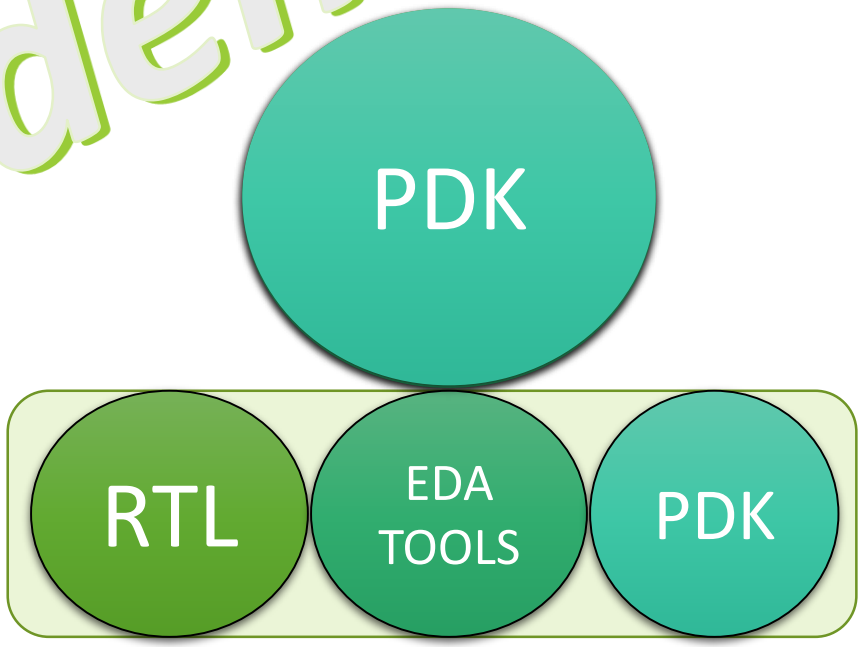
- What is a Foundry?
  - It is a factory where devices such as ICs are manufactured

Prerequisites for an ASIC Design

- 3 key ingredients
  - RTL/Design
  - EDA Tools
  - PDK

RTL – You can write on your own
EDA TOOLS – You can find open-source tools
PDK - ??????

Until June 2020, the open-source community did not have any solution for accessing PDK!



ASIC DESIGN

Sky130 PDK

- First ever open-source PDK
- Multiple process libraries
  - High speed
  - High density etc.
- Contains Standard cells operated at 1.8V
- 1 level of local interconnect, 5 levels of metal

LAB PRACTICE