OpenROAD

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What and Who?

- Open-source **EDA** (Electronic Design Automation) toolchain
- Complete **RTL-to-GDSII** physical design flow for digital IC
- Originally developed under **DARPA's IDEA** program**, UC San Diego**
- Partners are ARM, Qualcomm, SkyWater, NVIDIA...
- Competing tools from Cadence, Synopsis, Siemens EDA, Qflow...

They promise:

- To **democratize SoC design** by lowering cost, expertise barriers, and dependence on proprietary tools
- "24h, No-Human-In-The-Loop SOC layout design with no Power-Performance-Area (PPA) loss"
- "rapid design exploration"

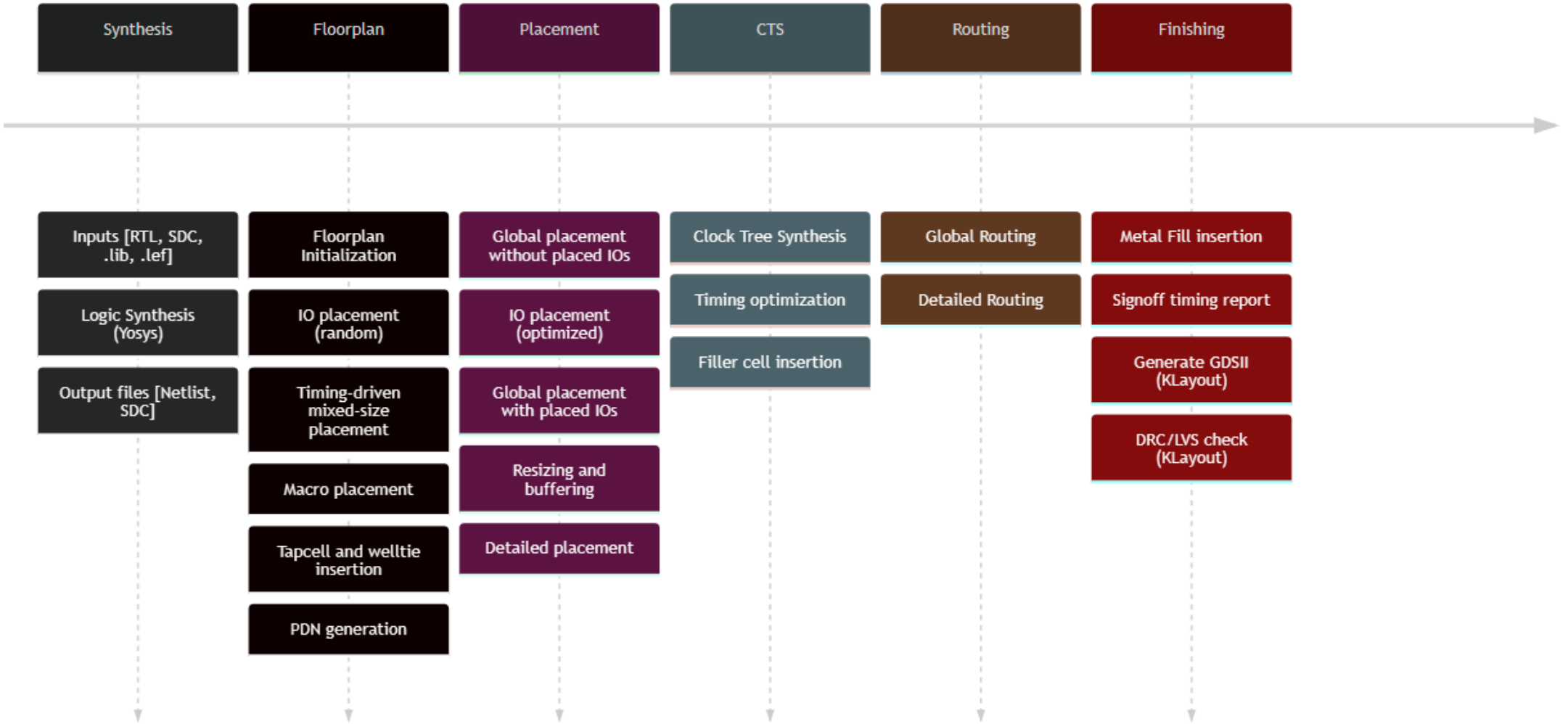
Languages and Tools

- **Primary languages:**
  - C++ (core tool implementation)
  - Tcl & Python (scripting interfaces)
  - Verilog for flow and examples
- **Tool uses / supported:**
  - Built with CMake and swig for TCL/Python binding.
  - Works with OpenROAD-flow-scripts, Yosys, OpenSTA, other open tools via scripts.
  - **BSD-3-Clause license** (permissive, allows modification & commercial use).

Getting Started

- Documentation available: detailed guides on building, installing, and running flows.
- Build options:
  - Prebuilt binaries (easiest)
  - Docker images (simplifies dependencies)
  - Local build via CMake.
- Example RTL-GDS runs
- Basic concepts (flow stages, scripting) are easy to understand, haven't tested it out

RTL to GDS using OpenROAD-flow-scripts



Benefits

- Lower barrier of entry
  - OpenROAD is free to use, compared to commercial tool licenses which can cost 10-100k annually
  - However, you still need to buy the necessary hardware to run the flow
- Open-source nature
  - Allows experimental tool modifications
  - Relatively active community around the project (~300 commits/week on gitHub, and on other platforms)
- Tested and available flows
  - The flow has been tested on some open and proprietary technologies
  - The open-source technology flows are freely available (GF180, SKY130, Nangate45)
  - Some proprietary technologies have been tested but the flows are not available because of the technology licensing, a reference flow is available to be used for any technology

Drawbacks

- No support
  - When a commercial tools is bought, some tool support is also provided, in form of trainings or direct communication with the support team
  - With OpenROAD, you must rely on documentation and community
- Lack of dependability
  - Commercial tools were already used for probably all available technologies, OpenRoad was used on just a handful.
  - The project was started in 2018; it still has to make a name for itself. (Cadence and Synopsys were creating silicon design tools since 1980s)