

Crossfire

Validation of Standard Cell Libraries, IO Libraries and IP's

Quality in Design Formats

Getting a consistent Standard Cell Library, IO library or IP out the door is a tough job. All too often during the design-process, problems like un-routable pins, incorrect Verilog or miss-characterized delay paths lead to failing tools, cryptic error messages and at best to unnecessary extra design-effort. Worst case, the entire design-schedule up to the tape-out deadline can be affected, or the manufactured chips might simply not work.

Crossfire addresses this problem by providing automated validation of Consistency, and Quality of the Design Formats. Crossfire will read all the various formats and views, from schematic to Verilog, Liberty and physical layout, and cross-checks the cell-descriptions. Whatever information is provided in a certain format, like delay paths in a .lib file, must be consistent with all other formats. In addition, Crossfire will verify cell quality and compatibility by asserting routability of pins and the correctness of delay tables.

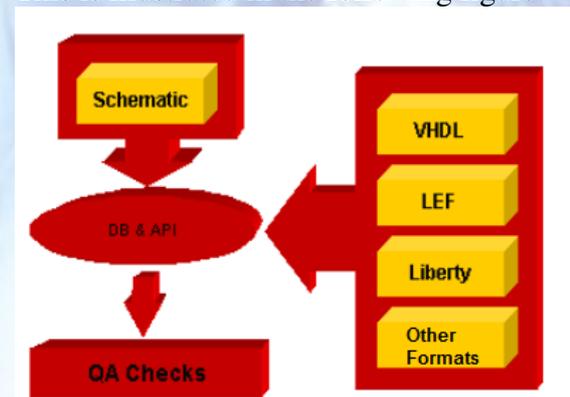
By providing such automated consistency checks, Crossfire is filling a gap left by the variety of tools, formats and EDA vendors involved in producing and consuming cell-libraries. Each tool demands its own

format, and will optimize a design, based only on the descriptions in its private format. Consistency between formats therefore, has traditionally been at the mercy of the development teams. This task cannot be underestimated: imagine having to guarantee consistency for each of the, on average, 200 data points per cell for an entire 800 cell library...

Crossfire is used as sign off tool, for incoming inspection and in the design flow. For example, before a new revision of a cell library is released to the design community, a Crossfire run assesses consistency and quality of the cell-library. Crossfire's extensive error reporting directs users immediately towards the cells that contain potential hurdles for timely completion of deep submicron ASIC design.

Crossfire Solution

Crossfire works by reading all the required formats into a central database, followed by a consistency check on this database. This is illustrated in the following figure:



By using a central database and API, each additional format that requires verification just needs to be read into the central database, after which all checks are available for the new format. Crossfire already supports most industry standard formats, but by virtue of this architecture can easily be enhanced to new or even customer specific formats.



Crossfire checks

Crossfire standard includes 140+ checks. Find below an overview based on the function of the checks.

Checking of library names:

Formats that use library names are checked for naming correctness and consistency

Cell presence

Cell Presence checks for missing or obsolete cells between the different formats.

DB Hierarchy

The formats: verilog, Verifault, Spice, OpenAccess and DFII may contain hierarchy. The hierarchical databases are checked for consistency. It is checked if all the required sub cells are present in the respective databases.

Terminals check

The terminals of all the formats are checked against the Golden Reference for presence and direction.

Label check

This checks if the text labels used match with the pin names from the Golden Reference. This check is only run on "back-end" formats only those formats contain text labels.

Net check

The Net check will check if the nets match in name with the terminals from the reference. It is also checked if each net has a terminal.

Functionality

This checks if all the functions are equivalent. When compared with the schematic or SPICE a formal verification is run on the netlist in order to compare the functionality

LEF cell size check

This checks whether all the cells adhere the "SITE" information of the LEF cells.

Cells are on PITCH in the X-direction and exact n times the height of a single cell.

Layout checks

This check compares polygon per polygon per layer to check if they are equal with the compared format. (XOR on polygons)

Abutment

The abutment check checks if the power rails and nwell cross at correct y-position at the boundary of the cell. Other layers (such as poly) can be and are checked too

Routability

An integral part of Crossfire is routability assessment for pins of cells and the overall compliance to place & route architecture of cell abstracts. Crossfire will measure and check cell height/width for routing grid compliance, verify correct locations of supply rails and the presence of mandatory power and ground terminals. A major show-stopper in any place & route design are pins that cannot be routed towards the cell-boundary. Pins that cannot be routed within the same layer as their drawn shape (usually first metal), present a serious risk of incomplete routing. Crossfire will attempt to route each signal pin in defined in the cell towards the cell boundary, using a wire of the same width, using an appropriate number of vias.

Characterization checks compare the arcs

This check checks for the structure of the arcs in liberty (NLDM) vs. each other or compared with the verilog formats. This means when a specific arc is found in liberty it must be found also in the verilog files (with or without the correct transitions). Furthermore the check verifies if the SDF back annotation works correctly. This means that an SDF



condition string can be traced to a verilog condition.

Arc presence vs. Function

Checks if the arcs described with conditions match the function of the cell.

Characterization data check for NLDM

This check is run on LIB data
Various checks are performed on the quality of the delay data itself.

[Detailed Crossfire Checks](#)

Characterization data check for ECSM

These checks are run on ECSM data only and consist out of a number of specific checks for ECSM data.

Characterization data check for CCS

These checks are run on CCS data only and consist out of a number of specific checks for CCS data.

Miscellaneous Checks

These are a group of checks created with our API that check various elements of a library or design.

[Detailed Crossfire Checks](#)

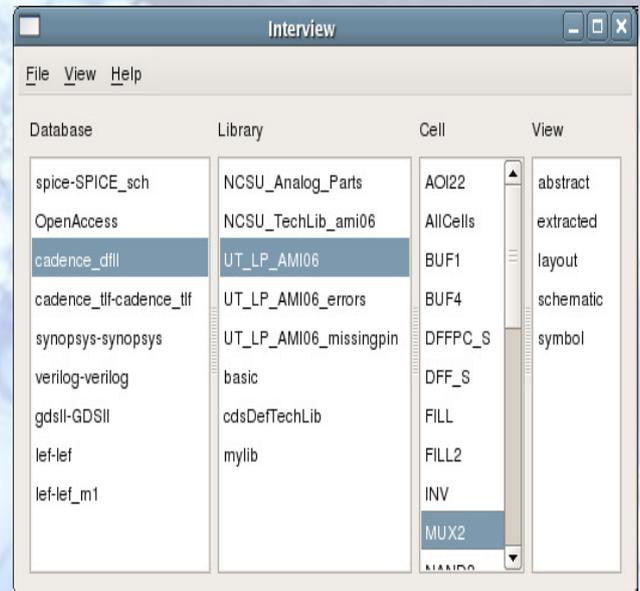
Crossfire usability features

- Graphical setup creation & run environment as well as batch runs
- Powerful hierarchical configuration language supporting macro functions
- Graphical debugging (message > double click > open relevant views)
- Graphical output filtering (zoom in on cells/formats/error-types)
- Automatic setup feature
- Waiving mechanism

Crossfire Viewing and Debugging:

Crossfire™ standard includes an option to view all formats on the spot. In these views

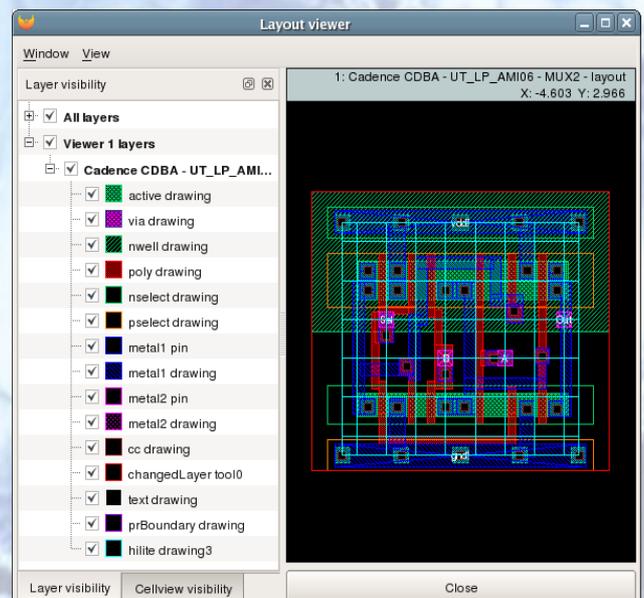
errors will be automatically flagged. By clicking on the error Crossfire™ will take you directly to the applicable data format. As a result debugging will become an easy and strait forward part of the validation flow.



Crossfire Interview

Visualization and browsing of database contents

Opens e.g. LEF, GDS, CDB, OA and Milky Way views in a single window

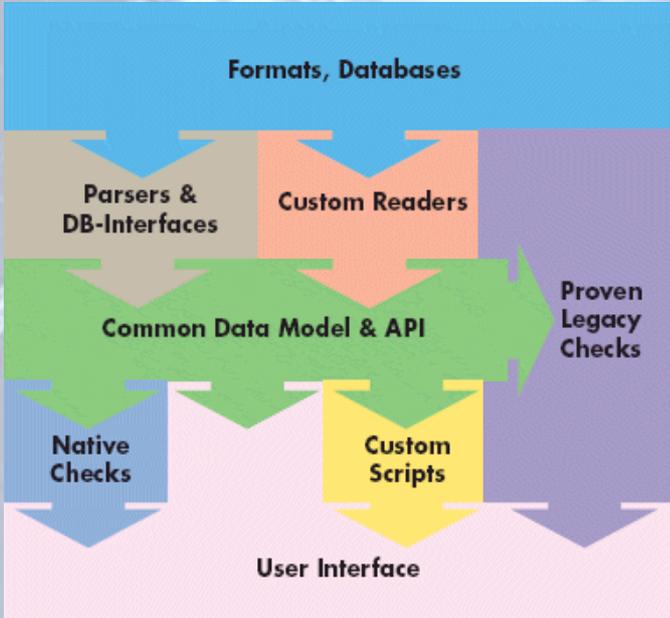
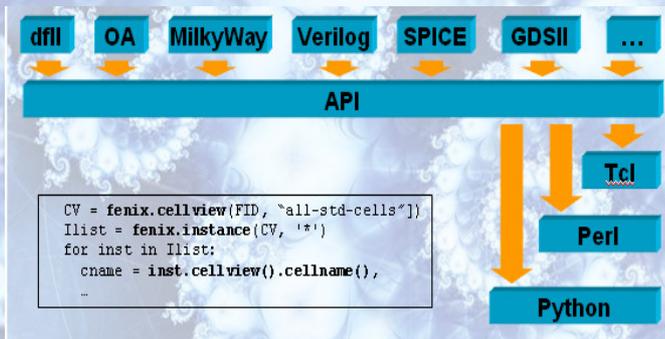


Crossfire™ API functionality:

Crossfire™ includes an API for creating database independent checks, available in: Perl, Tcl and Python

Existing customer validation scripts can be integrated

Visualisation messages/results from customer scripts (double click opens message)



Supported Formats

Crossfire is able to interpret and verify a continuously growing number of formats, including:

- Cadence DFII DB (layout, symbol, schematic, etc...)
- Synopsys Liberty format (.lib .plib) (NLDM, CCS, ECSM)
- MilkyWay DB (FRAM, CEL, etc...)
- Verilog 1995, 2001, Verilog AMS, System Verilog,
- Tetramax
- FastScan (atpg)
- VHDL (entity, component)
- Cadence .tlf format
- LEF
- DEF
- GDSII
- Open Access
- Spice (Hspice, CDL)

Because of its open architecture, additional formats can be easily added to the Crossfire database.

Supported platforms & license

Crossfire is provided under a time based license (TBL) for the following hardware and operating system platforms:

- Linux, RHEL4 x86 32 bit
- Sun, Solaris 2.8 32-bit, eol announced

Contact Fractal Technology

For more information concerning Crossfire please contact:

email: info@fract-tech.com

www: www.fract-tech.com