

Nirmaan - Software Development Toolkit for Post-Layout EDA

Nirmaan is a unique software development toolkit for EDA tool developers for accelerating the development of optimized Post-Layout EDA tools, including DFM (Design for Manufacturing) and Computational Lithography tools. At advanced geometry nodes, the Post-Layout software development challenges include handling of huge layout and mask data in excess of 100s of GBs and performing complex geometrical operations accurately in a fast and robust manner. Nirmaan is first of its kind, versatile software development toolkit that addresses this challenge and lets you develop Customized Post-Layout EDA solutions. Nirmaan includes efficient and scaleable geometric database and a host of fast geometrical operations commonly required for developing a whole range of Post-Layout EDA tools. Native interfaces are provided to most of the major industry standard Layout and Mask data formats. These interfaces enable plug and play with existing design environments.

Nirmaan enables Corporate CAD groups in semiconductor companies (including IDMs, photomask, wafer fabs and semiconductor equipment companies) and EDA start-ups to cut-down their Post-Layout Tool development time and effort by more than 2X. Currently, the only alternative for Post-Layout EDA software developers is to develop their own geometric database and geometrical operations along with the standard input and output format interfaces as part of their EDA tool development. Nirmaan is the first offering in the market that provides a ready-made, performance tuned and customizable infrastructural platform for these developers. Moreover, Nirmaan's innovative licensing models include royalty free use of derivative tools using Nirmaan, thus reducing Total Cost of Ownership of EDA tools.

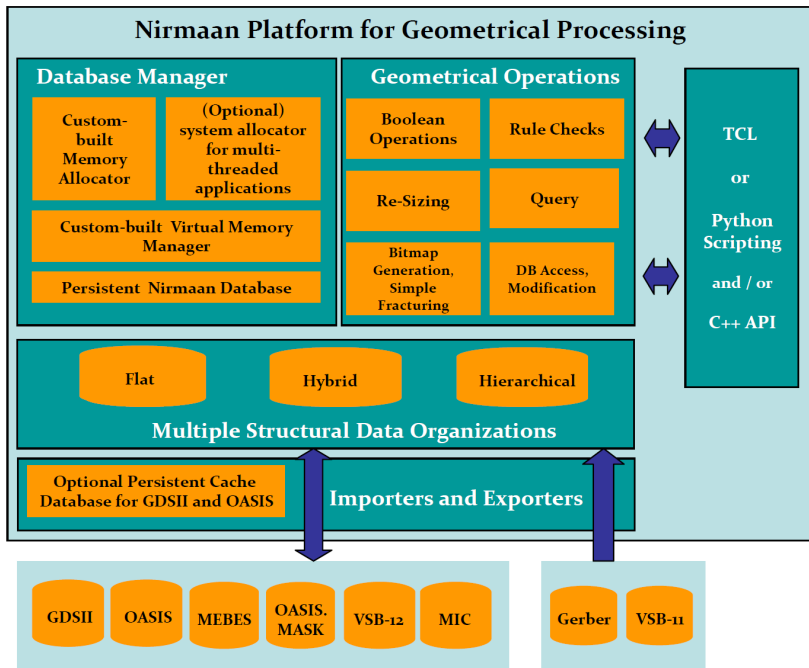
High Performance Geometrical Processing

Nirmaan is designed keeping in mind the existing and emerging performance challenges associated with processing huge IC layout and mask data.

- Nirmaan stores and represents geometric data in three organizational levels - Structural, Spatial and Raw Geometry level. At Structural level, Nirmaan has the capability to configure and store geometrical data in Flat, Hierarchical or Hybrid (a unique partially flattened data organization) modes. SoftJin's Hybrid data organization resembles Flat data organization in terms of its spatial properties and is thus well suited for parallelization. At the same time, it is closer to Hierarchical organization in exploiting the inherent hierarchy of the data for efficient computation and reduced data size
- Recognizing that the key performance bottleneck is not just computation but also the disk I/O associated with the reading/writing and the virtual memory involved during the data intensive operations, Nirmaan includes a variety of techniques including proprietary Virtual Memory Management (to optimize Disk I/O and reduce Thrashing), custom-built memory allocation for single-threaded applications, Cache-centric Algorithms for data processing and techniques for output file size reduction. Nirmaan allows usage of default System Memory Allocator for multi-threaded applications.
- Cache-file generation scheme enables fast pre-processing of GDSII / OASIS data and concurrent queries from multiple processes / threads
- As an underlying infrastructure, Nirmaan can also be used to develop Distributed Computing and Multi-threaded Post-Layout Applications. An (optional) distributed processing infrastructure is also available that enables quick development of typical parallel applications.

Key Benefits

- Versatile Software Development Toolkit lets you develop Customized Post-Layout EDA Solutions
- Re-usable platform for a range of Post-Layout tools including Rule Checking, MDP, MRC, RET, DFM/DFY tools and computational lithography tools
- Cuts down Post-Layout tool development time by more than 2X
- Efficient, Scaleable and Persistent Geometric Database easily handles over 100s of GBs of polygonal data
- Host of Built-in, Fast and Memory-efficient Geometrical operations
- Native Interfaces with all major industry layout and mask data standards, including GDSII, OASIS, Gerber, MEBES, OASIS.MASK, MIC, VSB-11 and VSB-12.
- Cache-files generation scheme enables fast pre-processing of GDSII / OASIS data and concurrent queries from multiple processes / threads
- Custom Virtual Memory Management to optimally handle Disk I/O and to avoid Thrashing
- Unique Hybrid Data Organization that combines the best features of Flat and Hierarchical Processing
- First of its kind C++ API access to infrastructure lets you create your own custom tool binaries
- Easy to use TCL and Python Interface allows you to build prototypes of your custom tools quickly
- Sample demo applications built using Nirmaan's C++ API along with their source code would act as reference implementation guide to the tool developers
- Innovative business model includes royalty free use of own custom developed tools



Unprecedented Flexibility

The key to Nirmaan's usability is the unprecedented flexibility it provides to Post-Layout EDA developers to create custom solutions of their choice.

- A host of fast and memory efficient geometrical operations that are commonly needed for a range of Post-Layout tools are included in the toolkit. These include all the commonly used Boolean, Rule Checking, Resizing, Window Querying operations. These operations work on Nirmaan's internal database and can be performed at polygon, cell, window and layer levels. For higher performance, these operations have ability to identify "patterns" and exploit the repetitiveness of patterns.
- A collection of operations are provided to directly access, traverse and manipulate the Nirmaan Database. Also there is facility to plug-in user written code through callbacks.
- Ability to add user defined properties and query based on property
- All the geometrical operations including Database access are exposed to developers through C++ API functions. Developers can write their own custom application using these API functions and link Nirmaan's object code libraries to create a single executable for the derivative tool. For ease of quick prototyping or instant end-use of Nirmaan's functionality, a TCL and Python interface is also available.
- All the major industry standard Layout and Mask formats are natively supported, thus freeing developer resources from developing these interfaces.

Key Features

- **Layout/ mask format supported**
 - GDSII
 - OASIS
 - MEBES
 - OASIS.MASK
 - Gerber
 - VSB-11
 - VSB-12
 - MIC
 - Job deck formats
- **Supported Geometry Types**
 - Manhattan
 - Octangular
 - All-angle
- **Multiple types of Structural Data Organization Supported**
 - Flat: Suitable of parallelism
 - Hybrid: Partially flattened, combines the best feature of Flat and Hierarchical
 - Hierarchical
- **In-built Geometrical Operations**
 - Boolean - Union (OR), Intersection (AND), Difference (SUB), Comparison (XOR), Reversal (NOT)
 - Multi-ops (cascaded operations)
 - Sizing (positive, negative, de-silvering, Grow/shrink)
 - Available at polygon, cell, window and layer level
 - Ability to identify patterns and exploit the repetitiveness of patterns
 - Window Query (Flat, Hierarchical)
 - Vector to Image Bitmap
 - Conversion of shapes to edges and edges to shapes
 - Simple Fracturing (trapezoidalization)
 - Rule Checks - Width, Space, Jog, Notch, Angle, Area, Sliver, Grid, Singularity, Run-length
 - Database access, traversal and manipulation
- **Interface to access database and operations**
 - C++ API for geometrical operations, data-organization population and access
 - TCL and Python interface for quick prototype development
- **Operating systems supported**
 - 32 bit and 64 bit Linux
 - 32 bit Windows

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About SoftJin

SoftJin Technologies develops Innovative and Customized Automation software for Electronic Design and Manufacturing. SoftJin offers several Software Products that address the challenges associated with IC Manufacturing at advanced process nodes including Post Layout Analysis, Optimizations and Mask Data Preparation. SoftJin's software products also serve as embedded components, Analysis and productivity enhancement tools for Lithography and Inspection equipments. See more details at www.softjin.com