

Nirmaan: Development Toolkit for post-layout EDA tools

Nirmaan™ is a unique toolkit for EDA tool developers, which accelerates development of optimized post layout EDA tools, including DFM/DFY tools. At sub 90 nanometer geometries, the post layout tool development challenges include handling of huge layout data and performing complex geometrical operations accurately in an efficient and robust manner. Nirmaan is first of its kind development toolkit that addresses this challenge. It includes a lean and efficient geometric data organization and a host of fast geometrical operations commonly required for developing a whole range of post layout EDA tools, including rule checking, mask data preparation, mask inspection, RET and DFM/DFY tools. Nirmaan enables EDA companies and In-house CAD groups of semiconductor to develop post layout tools faster, by helping them focus on their key value proposition rather than reinventing these capabilities.

Nirmaan Advantages:

1. Accelerates time to market of your EDA tool by more than 2X. Nirmaan provides a ready-made, performance tuned and optimized toolkit with multiple input/output interfaces with standard data formats and databases so that you can focus on your core EDA application development.
2. Enables scalability and high performance of your EDA tool, due to the scalable underlying geometrical data organization and fast geometrical operations.
3. Customization - The rich API support to access the data organization and operations at various levels provides developers the flexibility to create custom post-layout tools based on their design, technology and methodology requirements, rather than relying on standard tools.
4. Continuous seamless improvement of your EDA tool in terms of performance and support of industry standards.

Currently, the only alternative for post-layout EDA tool developers is to develop their own geometric data-model and geometrical operations. This could take approximately 60% of the total development effort and time of the whole tool. Nirmaan is the first and the only offering in the market that provides a ready-made, performance tuned and customized toolkit for post-layout EDA tool developers.

Nirmaan features:

1. Efficient Geometric Data-Organization Nirmaan stores and represents geometric data in multiple levels of

organizations these include Structural, Spatial and Raw Geometry level, which provides efficient and optimized base for performing geometrical operations required as part of post layout tools.

At the Structural level, Nirmaan has the capability to configure and store geometrical data in a variety of in-memory and persistent data organization choices. These include Flat, Hierarchical and Hybrid. While the previous version of Nirmaan included geometrical operations on Flat data organization, the enhanced version includes full support of all geometrical operations on Hybrid data organization. Hybrid data organization is SoftJin's unique partially flattened data organization targeted to make best use of the best features of the flattened and hierarchical representations. The 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 data organization in exploiting the hierarchy of the data for efficient computation and reduced data size. Depending upon the post-layout EDA tool being developed, the tool designer can select a particular type of Structural data organization that suits the requirements of the application.

At Spatial level, starting with a Quad Tree based spatial data organization, Nirmaan will be continuously enhanced to include a variety of spatial organization schemes, such as Voronoi diagrams, oct-trees. This would allow unprecedented flexibility to post layout tool developers to dynamically or statically select from those spatial organization schemes.

At Raw Geometry level, Nirmaan provides the geometries to be defined in terms of various primitives such as Manhattan polygons, all-angle geometries, rectangles, trapezoids, islands etc. Multiple options for representing data compactly are provided through schemes such as relative coordinate specification, compressed data to be decompressed on-demand..

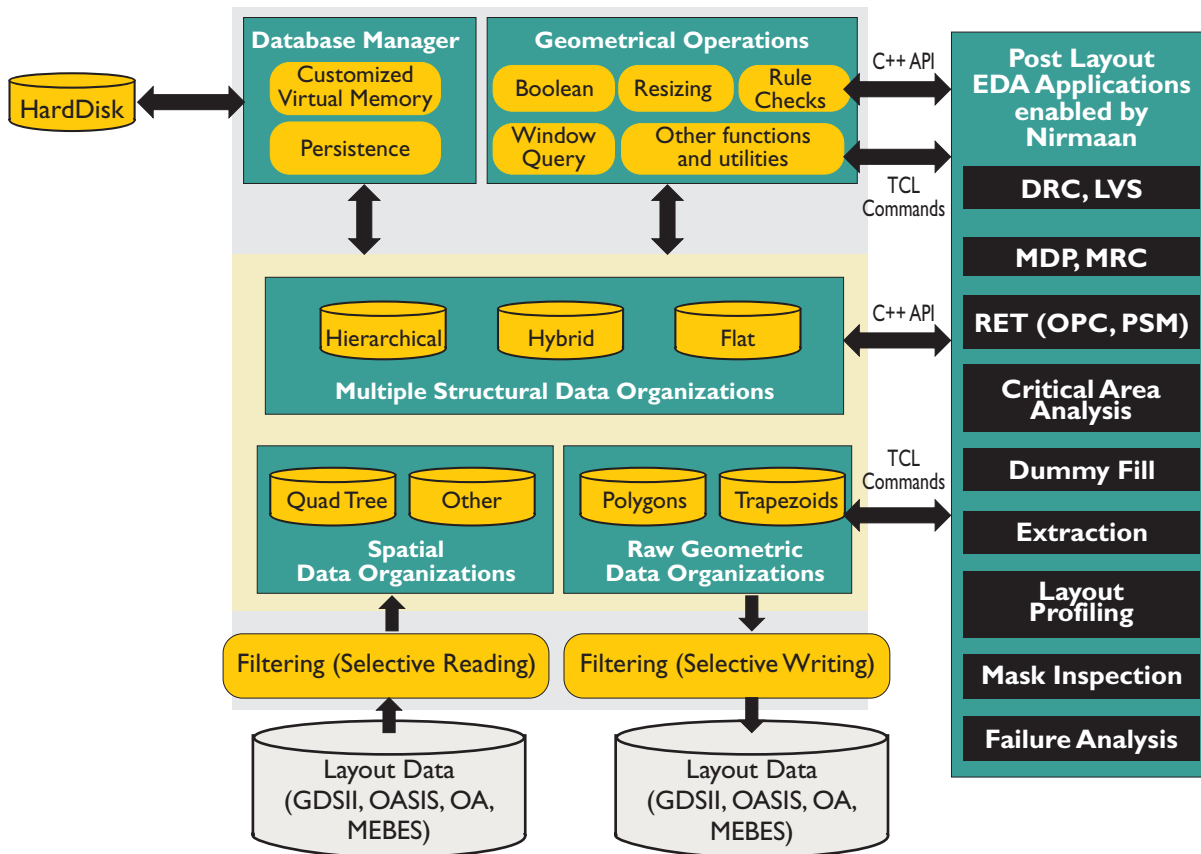
2. Range of Geometrical Operations - Nirmaan includes a range of geometrical operations including boolean, sizing, tiling/binning, window querying, rule checking etc. These operations work on the in-memory data organization in Nirmaan and can be performed at polygon, cell, window and layer levels. These operations support both Manhattan as well as all-angle layout geometries. C++ APIs for these operations

as well as data manipulation functions allow for easy tool development. Apart from C++ API functions, a TCL-based command-line interface is provided for key operations to expedite quick prototype tool development

3. Parallelism - Nirmaan's data-organization and operations are thread-safe. Multi-threading and distributed applications can be developed using Nirmaan.

4. Standard Interfaces - Nirmaan currently support most of the industry standard Layout formats and databases. These include GDSII, OASIS layout data formats, MEBES and OASIS.VSB Mask data formats and OpenAccess database. Other proprietary databases or formats can be supported as needed.

Develop Optimized post layout tools faster, better



Nirmaan 2 - Nirmaan 2.0 Beta version is available from July 2006. Nirmaan is licensed in object code form to EDA tool developers to include, build upon and/or sell as part of their post-layout tools.

The key enhancements in Nirmaan 2.0 over version 1.0 include:

1. Unique Hybrid data organization to increase the speed of geometrical operations and reduce both in-memory and on-disk data sizes. Early results show a 10X speed improvement and data-size reduction over the conventional flattened data organization.

2. A rich set of geometrical operations and a corresponding C++ Applications Programming Interface (API) provide more

flexibility to the Post-Layout tool developer. A TCL interface is also offered for quick prototype development.

3. Support for all-angle geometries.

4. Customized virtual memory implementation for optimized handling of huge layout data transfer between disk and main memory to minimize thrashing.

5. Efficient cache-usage centric algorithms for data traversal and processing

6. Read and write support for industry mask data formats including MEBES and OASIS.VSB

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