cādence®

Virtuoso Layout Suite XL

Rapid layout implementation

Part of the Cadence® Virtuoso® Layout Suite family of products, Virtuoso Layout Suite XL is a connectivity- and constraint-driven layout environment built on common design intent. It supports the physical implementation of analog, custom-digital, and mixed-signal designs at the device, cell, block, and chip level. Seamlessly integrated with the Virtuoso custom design platform and built on the OpenAccess database, Virtuoso Layout Suite XL ensures faster convergence on design goals and more efficient layout implementation.

Virtuoso Layout Suite XL

Virtuoso Layout Suite XL accelerates custom layout with a comprehensive set of user-configurable, easy-to-use pure polygon layout features within a fully hierarchical environment. Additional layout productivity is provided through optional param-eterized cells (Pcells) and SKILL, a powerful scripting language that provides direct database access, tool configuration, and interoperability with other tools.

Virtuoso Layout Suite XL has set the standard for layout productivity and changed the way custom block authoring is done. It is driven by a connectivity source from Virtuoso Schematic Editor or a netlist such as CDL or SPICE. A layout vs. schematic (LVS)-correct layout can then be created, ensuring correct-by-construction layout, higher produc-tivity, and shorter verification time. Virtuoso Layout Suite XL automates tedious design tasks such as device generation, placement, and routing. Users can cross-probe schematics and layout to highlight instances and devices, as well as quickly identify unconnected nets.
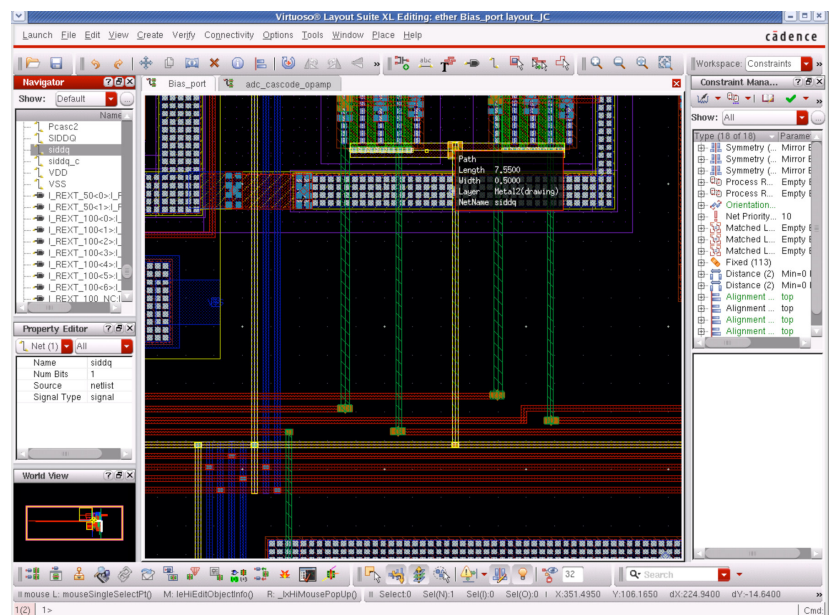

Figure 1: The industry-standard Virtuoso Layout Suite user interface

In addition to being a fully featured connectivity-driven environment, Virtuoso Layout Suite XL is built upon the Virtuoso common constraint system. Topological constraints, electrical constraints, and/or design-rule specific constraints can be specified and managed by Virtuoso

Schematic Editor, Virtuoso Analog Design Environment, or Virtuoso Layout Suite.

Once users set the constraints in Virtuoso Schematic Editor XL, Virtuoso Layout Suite XL can then be configured to either enforce the constraints while generating layout,

or automatically flag and log constraint violations that be resolved in subsequent design reviews.

Constraint- and connectivity-driven layout is a fundamental building block for realizing optimized, first-time correct silicon.

Virtuoso Layout Suite Family

The Virtuoso Layout Suite family of products comprises the layout environment of the industry-standard Virtuoso custom design platform, a complete solution for front-to-back custom analog, digital, RF, and mixed-signal design. The Virtuoso Layout Suite preserves design intent throughout the entire physical implementation process, while managing multiple levels of design abstractions from device, cell, and block levels through to the full-chip level. It provides the fastest path to design convergence for mature and advanced node silicon realization.

The Virtuoso Layout Suite includes three tiers of increasing layout automation and designer productivity. By selectively automating aspects of custom-analog design and providing advanced technologies integrated on a common database, engineers can focus on precision-crafting their designs without sacrificing creativity to repetitive manual tasks.

In addition to Virtuoso Layout Suite XL, the suite includes:

- Virtuoso Layout Suite L, a basic design-creation and implementation environment focused on layout productivity

- Virtuoso Layout Suite GXL, an extension to the XL tier, adds a robust set of advanced automated finishing tools to satisfy demanding physical design tasks such as floorplanning, placement, routing, and optimization; these technologies are the fundamental building blocks to rapidly realizing first-time successful silicon

Virtuoso Custom Design Platform

The Virtuoso custom design platform integrates Virtuoso Schematic Editor, Virtuoso Analog Design Environment, Virtuoso Multi-Mode Simulation, and the Virtuoso Layout Suite to speed convergence on design goals at every step for front-to-back custom analog, digital, RF, and mixed-signal design flows. The platform is backed by the largest number of process design kits (PDKs) available from the world's leading foundries, for process nodes everywhere from mature 0.35um to advanced 28nm. It is built on the OpenAccess database, engineered by Cadence for industry-wide interoperability.

The Virtuoso custom design platform also interoperates with the Cadence Encounter® digital implementation platform technologies via the OpenAccess database, providing a single, complete, coherent, and unified representation of design intent. This design intent is preserved throughout the entire physical implementation phase while operating with multiple levels of design abstractions (device, cell, block, chip), speeding design convergence to realize silicon for complex mixed-signal and system-on-chip designs.

Virtuoso Layout Suite XL Benefits

The XL configuration includes all Virtuoso Layout Suite L features (see respective datasheet) and offers these additional benefits:

- Captures and drives common hierarchical design intent with Virtuoso Schematic Editor—including connectivity, constraints, and power domains

- Enables interactive Pick-From-Schematic or automated Gen-From-Source device generation

- Enables automated SKILL Pcell-based device editing, including abutment, pin permutation, folding, chaining, and cloning

- Boosts designer productivity with rich set of assisted wire-editing functionality when creating custom interconnect

- Synchronous Copy command copies a group of physical objects that exist in the layout while maintaining synchronization among copied groups

- Includes menu-driven or programmable multi-part path (MPP) features for guard rings, slotting, etc.

- Features advanced synchronous cloning capabilities for generating and editing complex repeated layout patterns

- Enables easy configuration and visualization of large, complex designs using the configure physical hierarchy browser

- Addresses challenging next-generation design problems with common design intent using a connectivity- and constraint-driven environment
  - Constraint-aware and design-rule–driven editing for correct-by-construction layout
  - Automatic design intent and constraint checking
  - Automatic and dynamic design abstraction to handle more complex levels of design integration
  - High-performance connectivity-driven binder to handle designs with schematic-to-layout name mismatches

Virtuoso Layout Suite XL Features

Hierarchical, multi-window, multi-tabbed editing environment

Virtuoso Layout Suite XL enables users to open multiple cells or blocks in a single editing session, or to open different views of the same design, ensuring consistency in complex designs. Users can also open and manage their designs more quickly by using tabs, bookmarks, and history—similar to the functionality in today's popular web browsers.

A tabbed approach to viewing layouts simplifies window management and provides fast access to multiple designs in an intuitive manner. This is particularly helpful when copying portions of a layout from one design to another, or when using a pre-existing design as a reference.

Users can bookmark commonly accessed designs or view the history of opened designs. Bookmarks can be a single cell or a group of cells that appear in individual tabs. A "personal bookmarks toolbar" makes accessing commonly used bookmarks extremely quick and easy. Virtuoso Layout Suite XL shares the same look and feel with Virtuoso Schematic Editor and Virtuoso Analog Design Environment. This consistent use model enables a fully featured, intuitive, front-to-back design flow.

Docked layout assistants

Docked assistants are user-interface widgets that surround the main layout editing canvas. Virtuoso Layout Suite XL includes a rich set of assistants, including a Design Navigator and Property Editor, Search, and World View Assistants that significantly increase layout productivity.

Through the Design Navigator, users can quickly access specific cells that may be in a lower level of the design hierarchy via a tree browser built into the Design Navigator. Cells, nets, and pins can also be selected, sorted, and probed through the Design Navigator. This is a very effective feature when designing and debugging complex layouts.

The Property Editor Assistant is a new twist on the traditional "Edit Properties" pop-up form. The streamlined interface improves the effective area of the layout canvas space while decreasing mouse clicks and wasteful pop-up dialog boxes.

Through the Search Assistant, layout engineers have comprehensive search capabilities. The Search Assistant categorizes the "found" items into logical groups (cells, pin names, properties, etc.) and displays these items in a tree structure. This makes it very easy for users to find and access information within the design, the design libraries, menu commands, and even the SKILL manuals. Context-sensitive menus and double-click operations allow for rapid operations on selected results.
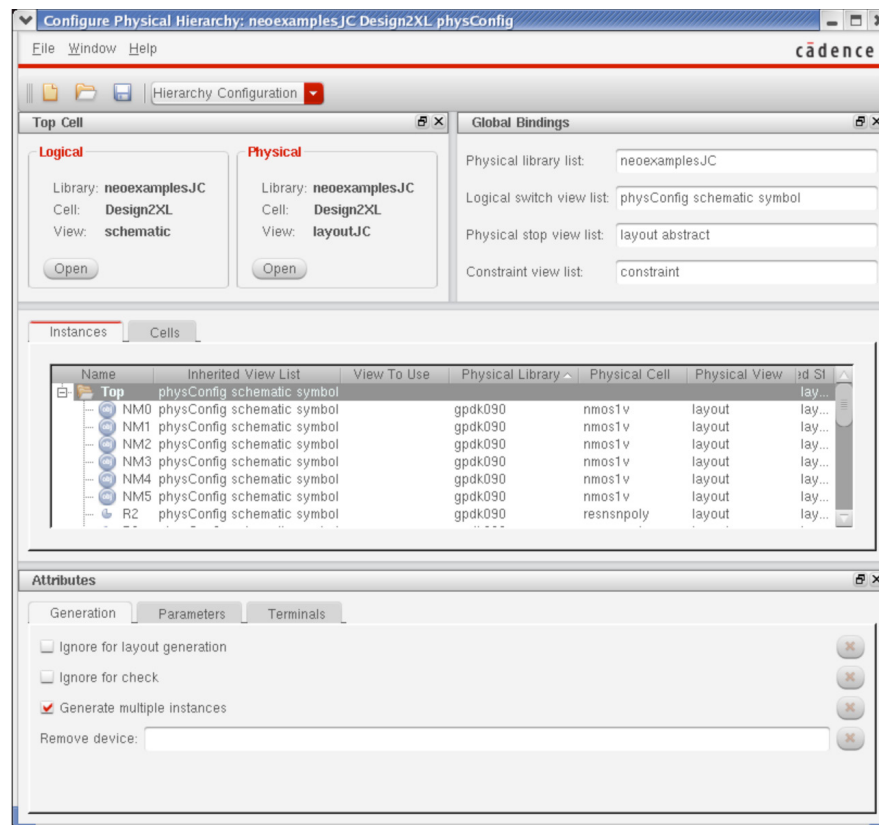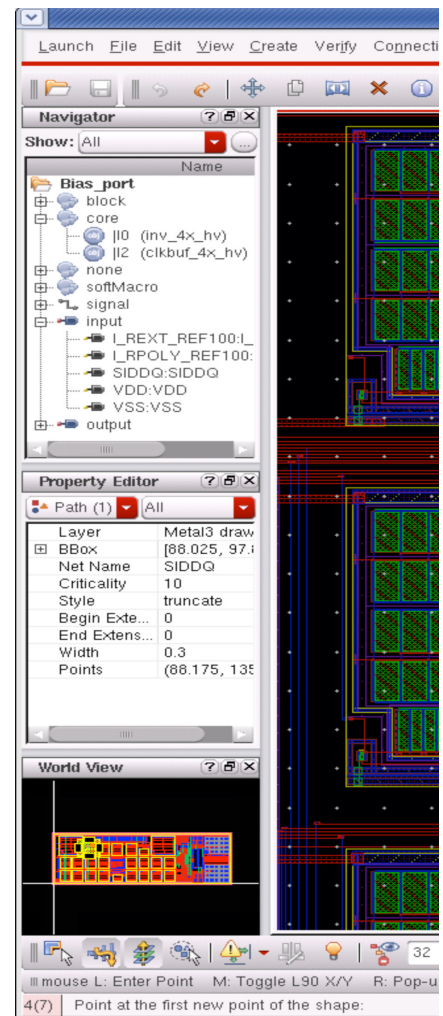

Figure 3: Docked layout assistants include a Design Navigator, Property Editor, and World View, which enhance layout productivity

The World View Assistant is an intuitive navigational aid that allows users to always see the entire design, even while zoomed into a specific section of the layout. This Assistant is particularly useful when working with large layouts where users have to perform editing while zoomed in on a portion of the design. The ability to concentrate on a specific section of layout while still viewing the overall layout decreases the need for repetitive panning and zooming. This translates into fewer mouse clicks, which improves layout productivity.

Flexible SKILL Pcells

SKILL parameterized cells (Pcells) provide an advanced level of design automation to minimize tedious and repetitive layout

Figure 2: The Configure Physical Hierarchy browser enables easy configuration and visualization of large, complex designs

tasks. Pcells support the changing of the size, shape, or contents of each cell instance without changing the original cell. They raise the level of abstraction to the component level, simplifying complex shapes and devices that can be generated, edited, and managed with variable settings. This results in faster design entry, accelerated layout, and fewer design-rule violations.

Highly customizable editing features

The architecture and implementation of the Cadence Design Framework II and the OpenAccess database allow Virtuoso Layout Suite XL to offer a customizable layout-editing environment and user-added features. This is made possible through the support of the flexible, powerful, and industry-proven SKILL programming language, which gives users direct access to the design database and tools to meet the design requirements of any custom design methodology. Additionally, the OpenAccess database supports a C-based API and toolbox to allow for tool customization and tool interoperability.

Design-rule–driven editing

Virtuoso Layout Suite XL provides real-time design-rule–driven editing that flags violations and automatically enforces design rules while the layout is being created. This promotes correct-by-construction layout, improving productivity and eliminating physical verification iterations. All technology file process rules are supported, including complex sub-32nm nodes.

Advanced layout automation

Virtuoso Layout Suite XL simplifies and optimizes block authoring with advanced layout automation features that leverage the design-rule–driven functions and flow. Dynamic Measurement minimizes the need to manually measure geometries. Alignment speeds up the task of aligning instances, pins, and objects. Mark Net efficiently traverses the physical design hierarchy and performs continuity checking and highlighting.

Connectivity-driven functions and flow

Virtuoso Layout Suite XL changes the way custom block authoring is done. Driven by schematic connectivity and constraint design intent established in Virtuoso Schematic Editor or a netlist source (such as CDL or SPICE), an LVS-correct layout can be done in real-time. This ensures correct-by-construction layout, higher productivity, and shorter verification time. Additionally, tedious design tasks can be automated, such as device generation, placement, and routing. Schematics and layout can be cross-probed to highlight instances and devices as well as quickly identify unconnected nets.

In Virtuoso Layout Suite XL, a new incremental connectivity-driven binding technology has been introduced. This approach is far superior to traditional name-based schematic-to-layout binders, which had severe limitations when supporting schematic-to-layout name mismatches. The connectivity-driven binder enables better support of legacy layouts that have name mismatches, and

also improves handling of engineering charge orders (ECOs) that involve renaming of instances and terminals in the layout. The incremental nature of the connectivity binder also greatly improves the performance of a connectivity-driven layout flow.

Constraint- and design-rule– driven functions

The Virtuoso platform is built upon a common constraint environment to ensure correct-by-construction layout, higher productivity, and fewer physical verifi-cation iterations. Topological constraints, electrical constraints, and/or design-rule specific constraints complete the design intent specified and managed in Virtuoso Schematic Editor, Virtuoso Analog Design Environment, or Virtuoso Layout Suite. Simply set the design intent constraints in Schematic Editor and Layout Suite can easily be configured to either enforce the constraints while generating layout or automatically flag and log constraint violations that can be discussed at subse-quent design reviews.
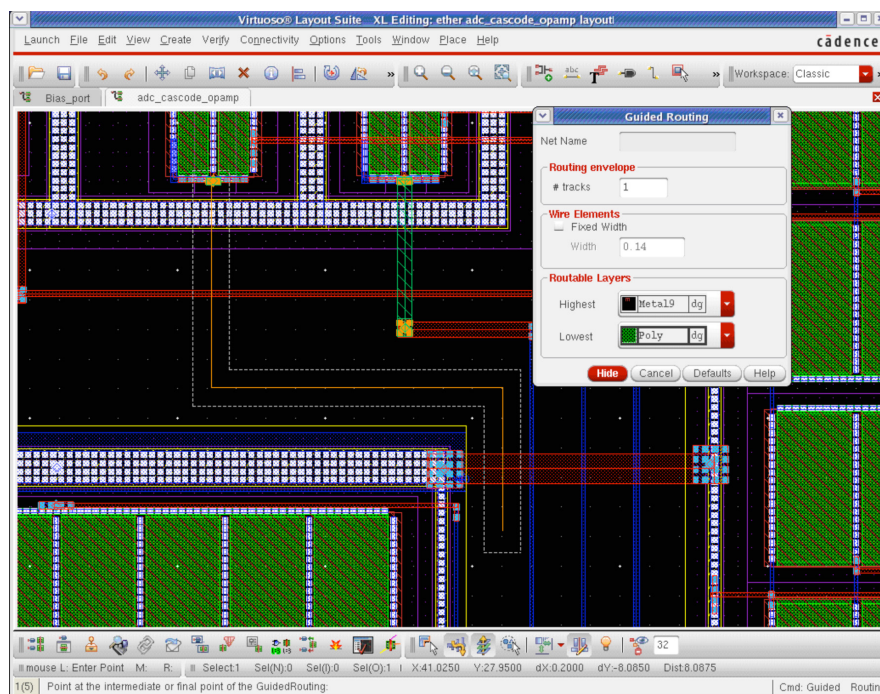

Figure 4: Robust assisted routing facilities include finish net, point-to-point routing, and guided routing

Integrated signoff constraint verification can be run and accessed from the docked annotation browser, simplifying the task of verifying that a design is meeting the design intent specification. Constraint verification can be done before, during, or after physical implementation of a design.

Advanced assisted wire editing

Virtuoso Layout Suite XL has a robust set of constraint/design-rule–driven assisted wire-editing capabilities. This comprehensive, fully interactive wire editor is natively integrated into Virtuoso Layout Suite XL and supports advanced process nodes along with an array of custom specialty routing types such as bus/bundle, differential pair, matched length, and symmetric.

In addition to driving the wire editor fully manually, users can also take advantage of the wire editor's assisted capabilities. Commands such as point-to-point, finish wire, pushing and shoving of wires, along with guided routing on single nets and buses, are built upon the Virtuoso common constraint system and connectivity-driven layout. These features are productivity enablers for almost all layout engineers, who no longer need to generate complicated scripts to get desired results.

Advanced editing with cloning

Virtuoso Layout Suite XL has a unique capability that allows users to "clone" portions of the layout without altering connectivity. What differentiates cloning from a more traditional copy of geometry is that cloning supports both a geometric copy and a connectivity update. This capability is essential in today's connectivity-driven methodologies. In addition to cloning, synchronous clones enable a single change in a member of a clone to update all partner clones. This capability greatly boosts productivity when working in a connectivity-driven environment.

Specifications

Third-party support

- OpenAccess-compatible tools and functions

- PDKs (please contact your foundry provider for more information)

Design input

- OpenAccess database

- SKILL

- STREAM format

- OASIS format

- Cadence Chip Assembly Router database format

Design output

- OpenAccess database

- SKILL

- STREAM format

- OASIS format

- Cadence Chip Assembly Router database format

Platform/OS

- Sun/Solaris

- HP-UX

- IBM AIX

- Linux

Cadence Services and Support

- Cadence application engineers can answer your technical questions by telephone, email, or Internet—they can also provide technical assistance and custom training

- Cadence certified instructors teach more than 70 courses and bring their real-world experience into the classroom

- More than 25 Internet Learning Series (iLS) online courses allow you the flexibility of training at your own computer via the Internet

- Cadence Online Support gives you 24x7 online access to a knowledgebase of the latest solutions, technical documentation, software downloads, and more

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