Synopsys PrimeClosure

Golden Multiphysics Signoff Closure for Giga-Gate Designs

Fast, predictable, full-chip closure at golden signoff accuracy to achieve 10X faster turnaround time and 50% fewer ECO iterations

Overview

Advanced-node designs now span billions of instances and hundreds of scenarios, with tightly coupled timing, power, and reliability requirements. Traditional ECO flows optimize these domains sequentially, driving repeated iterations, cross-domain regressions, and late-cycle unpredictability.

Synopsys PrimeClosure unifies multiphysics optimization into a single flow: timing, power, IR-drop, and reliability are analyzed and improved together, and each ECO is validated in real time against golden signoff engines—delivering signoff-accurate optimization along the way.

By replacing siloed handoffs with simultaneous convergence, it accelerates closure, improves signoff correlation, and makes outcomes more predictable.

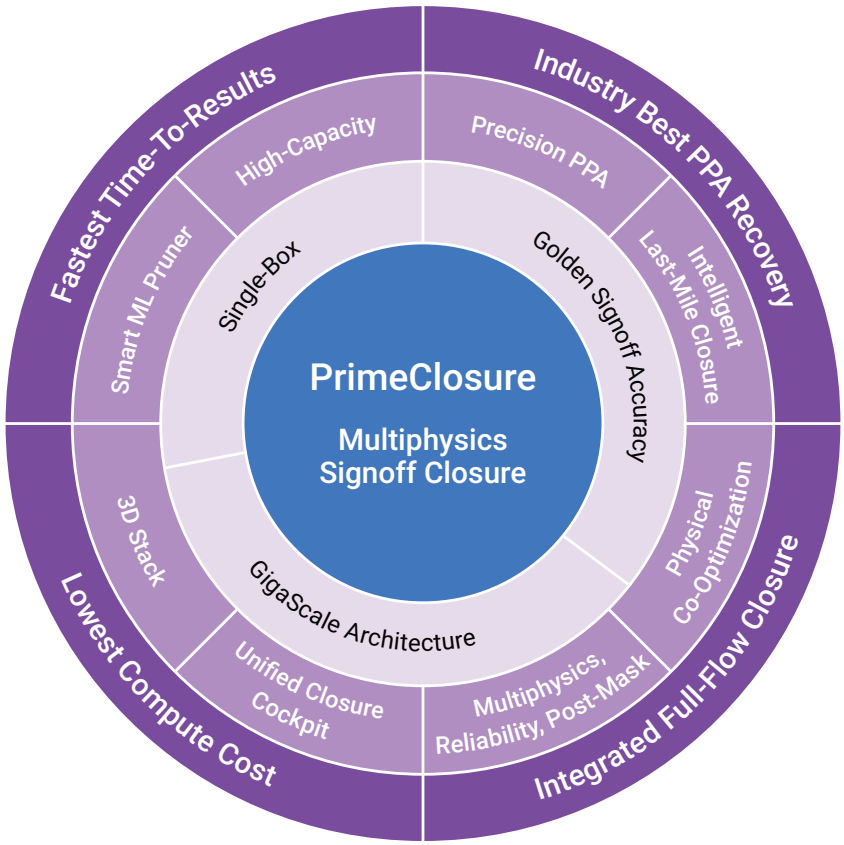

Figure 1: Fast, Predictable Multiphysics Closure with Golden Signoff Accuracy and Lower Compute Cost

Key Benefits

Faster, Predictable Convergence

- Up to 10x faster turnaround time with ~one-day closure cycles, enabling rapid convergence for giga-gate designs
- Up to 50% reduction in ECO iterations, accelerating convergence and reducing closure churns

Improved PPA Recovery (Power, Performance, Area)

- Up to 50% better timing recovery
- Up to 10% improved power recovery

GigaScale Efficiency

- Scales to billion-instance designs and hundreds of scenarios, eliminating traditional scaling bottlenecks
- Efficient single-system and few-machine execution, reducing dependence on large compute farms

Lower Compute Cost

- 2-4x faster runtime
- 2-4x faster design loading with >2x lower memory usage, improving performance while minimizing resource consumption
- Up to 50x reduced infrastructure footprint and compute cost per run

Unified Multiphysics Design Closure

PrimeClosure uniquely combines timing-aware optimization with signoff-accurate power integrity analysis to close late-stage IR in a single loop. Every ECO is validated inline against golden signoff engines, making results signoff-correct by construction and reducing cross-domain regressions, rework, and time to convergence.

This unified approach:

- Reduces IRECO iterations by 50-80%
- Accelerates IR closure turnaround time by up to 20x
- Reduces late-stage IR violations by up to 85%

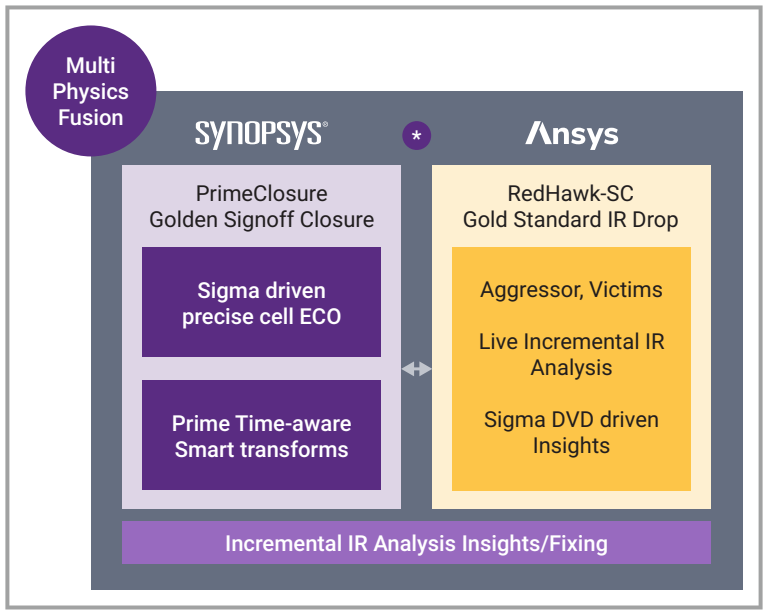

Figure 2: Fast, Predictable Multiphysics Closure—Eliminating Iterations with Signoff Accuracy

Golden Signoff Accuracy

PrimeClosure delivers signoff-accurate results inline during optimization, not after the fact. Unlike conventional ECO flows that use approximations only to discover violations late in the signoff process, PrimeClosure embeds golden signoff engines in the loop and validates every ECO in real time—eliminating separate post-optimization checks and enabling a more deterministic, predictable path to closure and tapeout.

GigaScale Architecture for Giga-Gate Designs

PrimeClosure's purpose-built GigaScale architecture enables efficient full-chip closure for the largest designs. As design size and scenario counts grow, traditional distributed ECO flows demand large compute farms, high memory, and multi-day turnaround—creating late-stage bottlenecks.

Designed for billion-instance chips and hundreds of scenarios, PrimeClosure runs on a single machine or a small number of systems, cutting infrastructure needs while improving turnaround time. Intelligent partitioning delivers 2–4× faster loading, >2× lower memory, and 2-4x faster closure—reducing compute cost without sacrificing signoff accuracy.

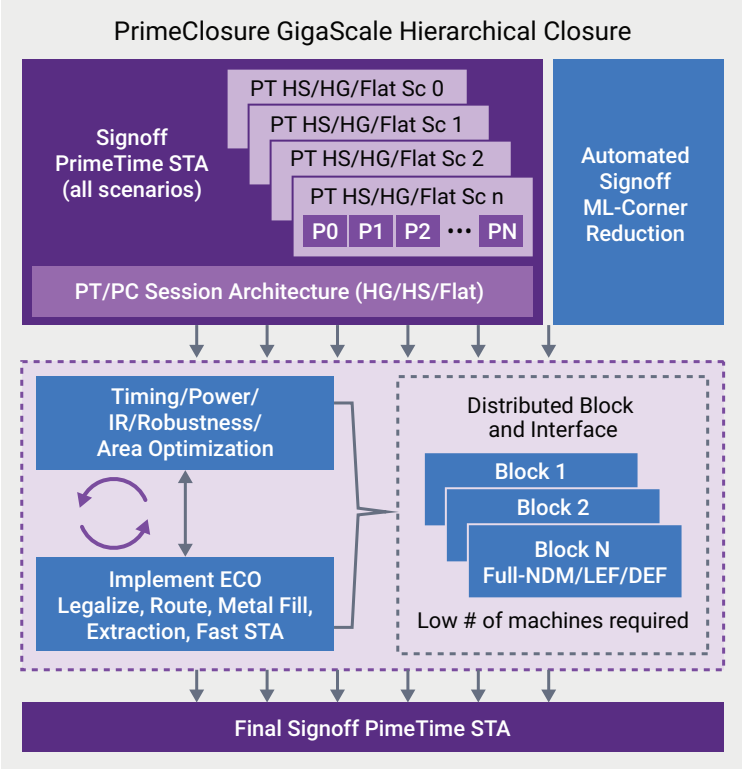

Figure 3: GigaScale Architecture Enabling Efficient, High-Capacity Closure

Precision PPA Optimization

Late-stage power signoff demands precise, high-impact changes. PrimeClosure applies targeted ECO optimization on datapaths and clock paths, improving timing, power, IR-drop, and reliability together using live golden signoff feedback and multiphysics awareness. This minimizes design disruption while maximizing PPA/QoR without introducing cross-domain violations.

Accelerated Convergence Through Intelligent AI/ML Automation

Conventional ECO flows depend on manual, domain-by-domain iterations and repeated tool handoffs, causing regressions, slow convergence, and unpredictable schedules. PrimeClosure replaces this with intelligent, multiphysics-aware automation that optimizes timing, power, IR-drop, and reliability together in a single loop, validating every change inline against golden signoff engines so fixes are correct by construction. Advanced algorithms search the full design and scenario space for the highest-impact moves, cutting ECO iterations, eliminating rework, and delivering faster, more deterministic closure.

Integrated Full-Flow Design Closure

PrimeClosure is integrated across the Synopsys digital design flow to maintain consistent QoR from implementation through signoff. It works with Fusion Compiler and is tightly coupled to PrimeTime, RedHawk-SC, PrimeShield, PrimePower, StarRC, and IC for signoff-accurate, cross-domain validation—reducing flow gaps, manual data translation, and redundant rechecks for faster closure.

Unified Closure Cockpit

PrimeClosure offers a unified closure cockpit that combines visualization, analysis, and ECO implementation in one environment. Engineers can quickly inspect timing paths, power integrity hotspots, congestion, and layout data to pinpoint root causes, then apply and validate automated or manual ECOs without switching tools—reducing complexity and accelerating debug and closure.

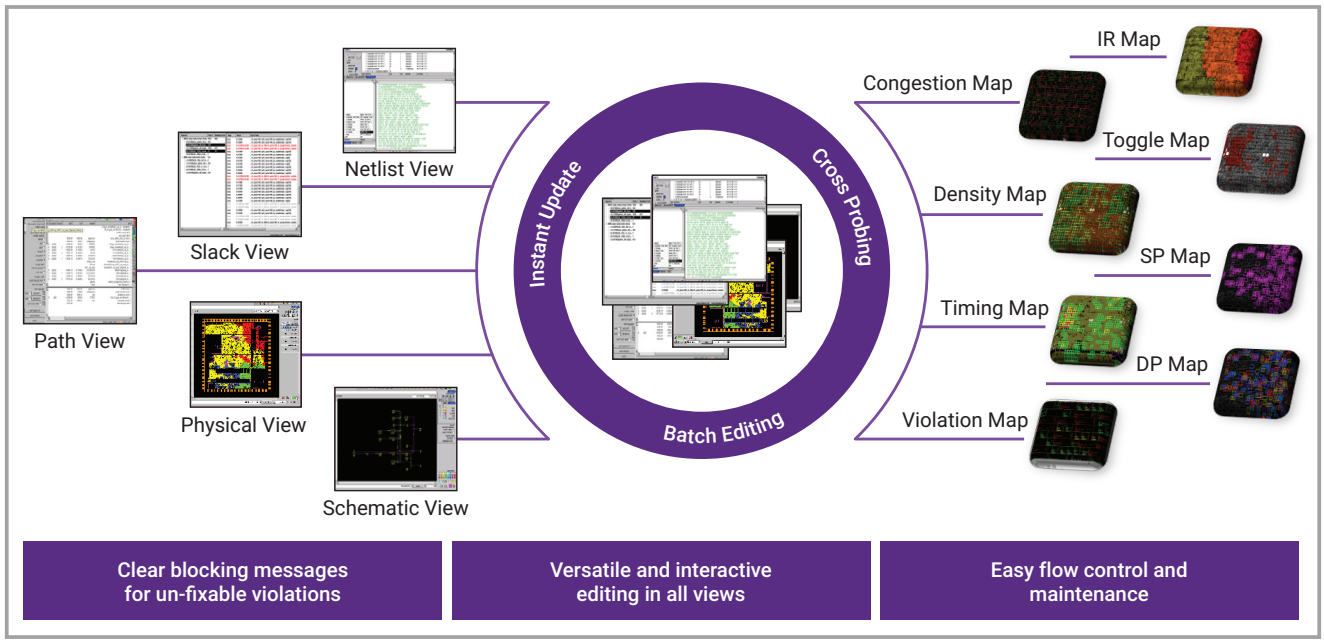

Figure 4: Unified Closure Cockpit for Interactive Analysis, Debug, and Efficient Manual ECO Execution

Summary

PrimeClosure replaces fragmented, iteration-heavy closure with a unified, multiphysics optimization flow. With GigaScale scalability, inline golden signoff validation, and simultaneous cross-domain optimization, it delivers faster, more predictable full-chip closure for advanced-node designs.

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