VERIFICATION MANAGEMENT

Electronic design verification is an inherently risky undertaking. The end product is smaller than a thumbnail yet contains millions of gates that all must function perfectly together. To remain competitive, design teams must keep up with the generational changes in semiconductor process technology. This requires adopting new design and verification methods every two or three years. Of course, incorporating new verification languages, methodologies, and technologies brings its own risks to your project. The key to success is appropriately managing all of these risks.

The most crucial step to reduce verification risk is automating the verification process. Cadence provides verification process automation (VPA)—from plan to closure—that removes process risks. This upfront planning process enables you to estimate your resource requirements, assign tasks to each engineer, and define the coverage goals and other metrics you will use to measure your progress.

To successfully perform the entire process—from verification plan to closure—depends on having the right tools to get the job done. This document is one of a series of Cadence® Incisive® technical briefs that identify key Cadence products and their technological advantages that make it easy for you to incorporate new languages, methodologies, and technologies into your verification environment while managing the associated adoption risks.

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METRIC-DRIVEN VERIFICATION PROCESS MANAGEMENT FROM PLAN TO CLOSURE

Automating the verification process offers the most effective way to reduce risk and improve efficiency, predictability, and product quality. Today's leading verification teams rely on testbench automation technology for accurate coverage metrics and increased productivity. This technical brief focuses on Incisive management, which automates the verification management process, optimizes resource utilization, and improves project-level schedule and cost predictability.

To reduce risks in functional verification, it's important to begin with the end result in mind. This means starting with a comprehensive plan and then continuously measuring progress against the plan throughout the project. But achieving an accurate view of the project status requires gathering and processing large, dispersed volumes of metric data.

Verification planning is an incredibly challenging activity. Essentially a creative process that follows a structured approach, it requires a balance of art and engineering. Repeatable methodology is important to bring this art to a form that returns value across an enterprise, and technology for capturing plans during the creative process can facilitate faster adoption within an enterprise.

Without an automated process for measuring progress, managers are forced to take shortcuts or make risky midcourse corrections based on incomplete and flawed data. The complete picture often comes into view too late, resulting in slipped schedules and inefficient use of resources.

Automation is crucial at this stage: Running additional simulations results in the capture of additional coverage metric data, which could easily overwhelm even a large verification team. Only automation delivers an accurate view of project status, enabling engineers to make decisions that increase project predictability, quality, and efficiency.

AUTOMATING THE VERIFICATION MANAGEMENT PROCESS

To help design teams address the growing challenges in verification, Cadence pioneered the commercialization of automated verification management technologies. Tailored to project and verification managers, Incisive management combines a powerful executable verification plan, meaningful metrics, and associated analysis engines to guide the verification process from plan to closure, starting first with technology to guide the planning process itself.

Incisive management also gives managers critical, up-to-date information. Session control technology further enables the efficient utilization of distributed regression resources, while failure analysis and debug help close the loop when simulations fail.

The Incisive automation technology makes planning and metrics an integral part of the verification process and enables significant improvements in schedule predictability, resource utilization, and productivity—all of which are essential for managing today's complex verification projects.

TECHNOLOGY ADVANTAGES OF INCISIVE MANAGEMENT

1. VPLANS DRIVE THE PROJECT FROM PLAN TO CLOSURE

vPlans represent one of the most unique technical innovations in Incisive management. Project teams can use vPlans as the basis for their entire verification planning process and as a means to capture those plans in an organized fashion. vPlans can also act as contracts between engineering teams and management, capturing product requirements in a form that is used explicitly to measure whether a design is ready for tapeout.

The essence of a vPlan is the identification, measurement, and reporting of key project metrics. Total coverage is recognized in the industry as the best metric for quality and verification closure, and is the cornerstone of the integrated Incisive functional verification platform. A vPlan combines

multiple sources of coverage, including functional, code, static and dynamic assertions, transaction, SystemC® code, software driver, and/or application code. A vPlan can capture and track all forms of project metric goals from plan to closure.

vPlans are organized hierarchically and can be based on the goals and milestones of the project, independent of the architecture of the device or system being verified. They enable reuse; for example, vPlans from a block-level verification project can be incorporated directly into a vPlan for a subsequent system-level simulation, or for a new derivative design. The hierarchy can be used to organize the logical functionality of the device or system, separating out blocks, major subsystems, software components, and the overall system. Each level can have its own view and approach to verification; the vPlan brings all the verification results together for rapid viewing, analysis, and report generation.

vPlans can be created manually, as in editing a structured plan language in a formal plan document. Or the Planner can be used to create plans more easily, helping teams extract valuable knowledge about their design and translate it into appropriate verification goals.

The vPlan is an important part of the Compliance Management System (CMS), which combines the stimulus to drive generation to reach compliance, the coverage model to measure coverage, and the vPlan to assess the coverage against compliance with the protocol.

2. AUTOMATED SESSION MANAGEMENT LAUNCHES AND TRACKS SIMULATIONS

A session is a group of simulations that collectively verify some subset of the overall device or system under test. The simulations could be a complete system- or block-level regression, or could be organized to verify a targeted scope of the vPlan. Incisive management stores organized descriptions of these sessions, capturing all the pertinent simulation attributes that are designed into each, as well as refinements discovered over the life of the project.

Incisive management launches sessions using dispatch technology such as LSF to leverage the workstation and license resources. It then tracks session progress. Automatic debug runs can be configured. Any failing simulations can be automatically rerun with debug flags turned on so that users can immediately focus on debugging, without having to initiate those simulations manually.

3. FAILURE ANALYSIS SIMULATES TRIAGE RAPIDLY

The quick-click failure analysis capability of Incisive management provides rapid identification of the most important simulation failures resulting from one or more sessions. Multiple session results can be viewed together, enabling common failures to be grouped such that unique failures are emphasized and redundant work on common failures is eliminated. Valuable information such as time of failure and even location in the design can be filtered so that the common aspects of the failure can be more easily identified. Failures can be correlated between simulation runs to determine if there is a particular bug that has a broader impact beyond the local context in which the error was first flagged.

Incisive management also provides automated revalidation of bug fixes. For example, if 200 simulations fail and 70 of them fail in the same way, it's likely that a single bug fix will impact all 70 failing simulations. Incisive management automates the selection and re-execution of those failing simulations to verify a particular bug fix. Without this automation, it could take hours to create and rerun the scripts manually.

4. VPLAN COVERAGE ANALYSIS DRIVES CLOSURE EFFICIENTLY

To achieve rapid verification closure, engineers must be able to create unique simulations with as little redundancy as possible. Identifying areas not previously covered (also known as holes) is critical to reduce the risk of failure. Incisive management includes integrated coverage hole analysis, which helps identify the largest, most targetable uncovered areas. The hole analysis technology is driven from a selected context in the vPlan and looks for relationships between coverage holes that help the engineer envision the most efficient simulations for improving coverage.

Incisive management also provides contribution coverage ranking, which identifies those simulations that contribute the most to the overall coverage goals. By ranking the simulations based on their relative contribution, the verification team can elect to run the smallest number of high-impact simulations that yield the greatest increases in coverage. This helps reduce schedule slips during the final stages of the project, when the regression test needs to be completed as quickly as possible. Removal of redundant simulations has more impact on reducing verification risk than even the biggest advancement in simulation performance ever could.

5. VPLANS CREATE INTEGRATED REPORTS AND CHARTS

Summary reports and charts are an essential means of abstracting simulation results for the purpose of assessing and communicating progress, identifying any appropriate adjustments in resources or priorities, and ultimately averting the risk of failure. Incisive management generates two important types of reports:

- Overall status reports, which summarize compliance with the plan and provide an early indicator of potential problems
- Scope-specific reports, which focus on areas that are either high risk or most important to the success of the overall project

As the complexity of SoC and ASIC designs continues to grow, so do the levels of risk. Only verification process automation and management can eliminate this risk. Without Incisive management, the seemingly simple process of measuring the current state of a project becomes overwhelming and makes generating accurate, timely status reports impossible. Verification process automation with Incisive management enables management to make the timely decisions necessary to avert project risk through continuous measurement, refinement, and reporting.

THE VALUE OF CADENCE VERIFICATION MANAGEMENT TECHNOLOGY

Automated verification management is a key element of verification process automation and can have a dramatic impact on overall verification team effectiveness. Staying on schedule depends on the ability to develop and refine a comprehensive verification plan, to regularly measure and track the right leading indicators, and to make resource allocation decisions efficiently.

The ability to automatically monitor key metrics that expose impending risk or deviation from the plan is a major Cadence innovation. Incisive management provides automation technology that makes planning and metrics an integral part of the verification process, and enables significant improvements in schedule predictability, resource utilization, and productivity—all essential for managing the complexity of today's verification projects.

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