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ENHANCING PREDICTABLE DESIGN EXECUTION

The predictable nature of design teams will be improved through a broader view of the design landscape to be managed by design.

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Introduction

In many design teams today, predictable design execution to the plan is a desired goal, although frequently it remains unachieved. This tends to be more prevalent in larger mixed signal or analog designs than those that are mostly digital. If a predictable nature is an unattained goal for your team, it may be time to look at design activities beyond the typical design flow items. There is likely a lack of clarity around assorted support, non-design type activities that the design team must complete in order to ensure the desired crisp execution of the design. Design teams that manage beyond the basics of schematics, simulations and layout will display predictable progress towards the agreed milestones.

PREDICTABLE DESIGN EXECUTION DEFINED:

"Everyone on the product development team will know what they are delivering, when it's expected to be delivered, how it's being delivered and where it's being delivered for every item they are responsible for. Conversely, every member of the team will know what they are receiving, when they expect to receive it, how it will be delivered to them, who is delivering it and where it will be delivered to them, for every item they will be receiving."

Broadening the Design Landscape

Predictability will flourish when the IC design landscape is viewed from a broader perspective than typical CAD or CAE type tasks and encompass all the essential support activities. Examples of the broader support type activities to be managed would include those associated with scope change, test capabilities/features and scheduling tradeoff decisions. Other instances include tasks associated with managing closure of the product specification, best practices (what, where, why & how), design flow development, simulation plans and design review strategies. This is only a sampling of typical supporting activities that must be considered as components of a thorough design plan. Figure 1 provides a detailed view of the total landscape to be considered. The identity of supporting activities beyond typical CAD/CAE type tasks is unique to each organization and must be recognized and managed from within design, thus allowing the chip to come together without a hitch as the fracture date nears. Leaving any of the support activities off the design management list, or failing to identify all the supporting activities will preface a surprise for the project, resulting in an unplanned diversion of activities and a slip in the schedule.

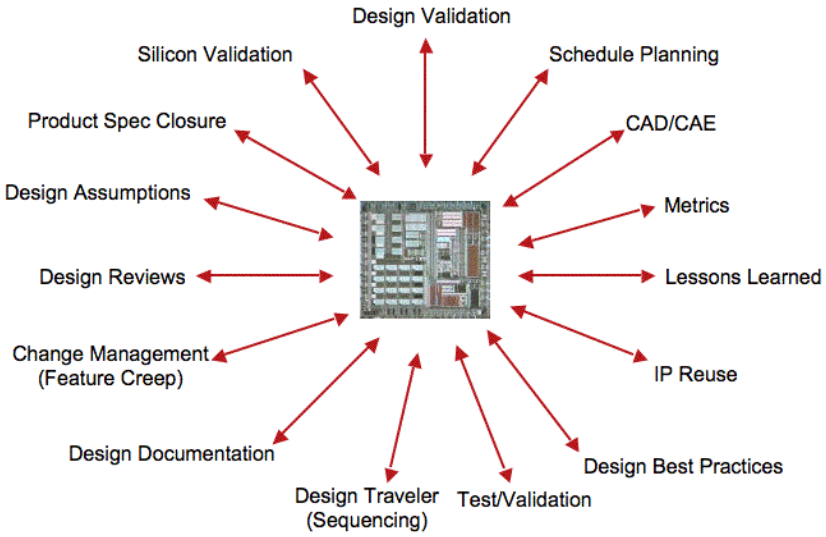

Figure 1: Design Process Landscape to be Managed by Design

The discovery of all the supporting activities does not come without homework. Any assumption that all the supporting activities are already well known will surely lose the battle before it has begun. The mission must be to find the supporting tasks that are not widely known to the team. If I were to go into any product design organization and ask what activities must be completed prior to fracture, they would have a lengthy list of items to share. A larger concern should exist about items that are not on the list and their lack of identity is quietly steeling away precious development time without any fanfare. You must be looking for subtle disconnects that prevent the smooth flow of information through design from concept to production. Consider the deliverables necessary to feed into later activities. Look for activities that are needed to support the success of product engineering, test, systems, program management and marketing in their role on the project. Figure 2 provides the scope that must be considered in your quest of uncovering unknown or unmanaged activities.

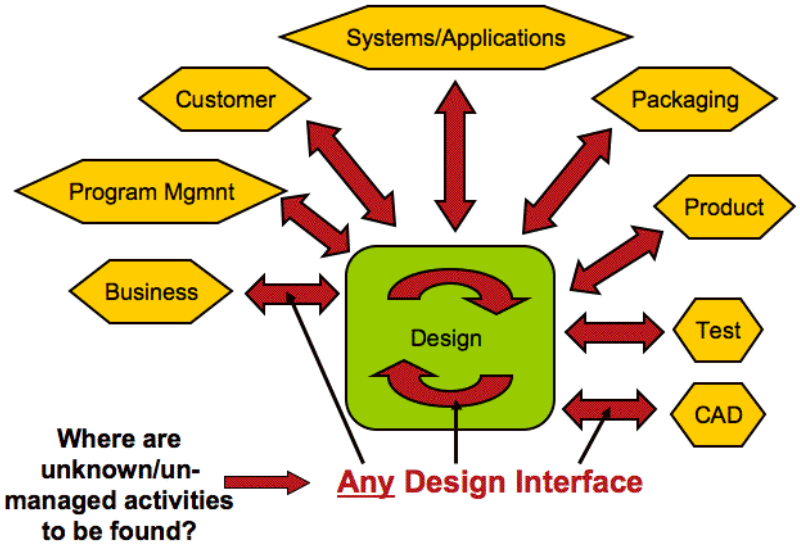

Figure 2: Scope of Search for the Unknown Activities

Recognition all of the hazy, unfamiliar supporting activities to be managed is best handled through a formalized discovery process with the product development team. Components of discovery include one on one interviews and group brainstorming sessions targeted at uncovering gaps in activities that prevent crisp execution of design. Figure 3 indicates the relative number of known design activities to be managed as you progress through a formal discovery process. You begin with a known set of tasks and as you journey through the process of identifying all supporting tasks, the list of items to be planned increases. Completion of this produces a list of all activities that design must own and successfully manage to closure, thus enabling a predictable workflow.

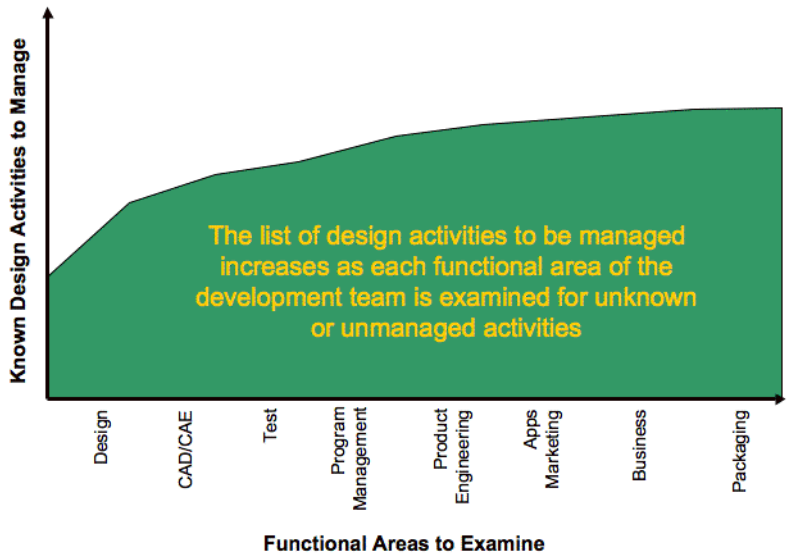

Figure 3: Uncovering the unknown/unmanaged Design Activities

When embarking on a discovery process it is essential to keep the focus broad, cover multiple areas and multiple engineering disciplines. As noted in Figure 2, uncovering the unknown supporting tasks requires visualization beyond the designer's domain. The process must probe around in test, product engineering, marketing, applications and beyond. You will probably find that many unknown activities have their roots based in the lack of required information transfer between individuals on the product development team. Someone did not know what information was required to be delivered **and** someone did not receive what he or she needed.

Considerations for Activities to be Managed by Design

This section will review several functional areas in the design landscape that should be considered as you engage upon your mission of discovering the unknown or unmanaged supporting design activities. These examples are meant to rouse your thought process as you consider the scope of tasks to be managed on your next project.

PRODUCT SPEC CLOSURE

Closure of the product requirements can drag on for as long as it takes to actually complete the design activity if not managed well. Specification closure must be an integral part your design plan. Break the requirement closure activities down into bite size tasks and manage them. Swift clarity of product expectations will result out of this typically gray, hazy portion of the project through a well-managed process. Realization of a reduced product development cycle will require the crisp, efficient closure of the product requirements for your project.

DESIGN ASSUMPTIONS

Design assumptions are the design groups outlook of the what, how, where and when of their deliverable back to the business. Without assumptions from design in place the business is likely to make their own assumptions about what design will produce, leaving a disconnect in expectations as a likely result. Items for consideration as part of the design assumptions include the baseline process, number of metal/poly layers, die size (make clear scribe or no scribe), package type and characteristics, resource assumptions & schedule. Activities associated with closure on the design assumptions should be part of the project plan for the project.

DESIGN REVIEWS

Design reviews tend to have more activity than is typically planned for. I frequently see this activity rolled up into a task of a day or so long. Review preparation activity will easily extend more than a day, assuming the review is to be a working session. Manage the expectations of what goes into the review and the actions of what comes out of the reviews to reap the benefits of this important quality check. Make sure you understand the review needs of test and product engineering and address any activities related to completing them. Multiple tasks will be part of thorough review. If review expectations are not cleanly identified the review content will be inconsistent across all of the design work, leaving gaps in quality control for design.

CHANGE MANAGEMENT (FEATURE CREEP)

Feature creep is a sneaky consumer of precious engineering resources. Not having a formal change management process in place enables the team to be quietly diverted to non-planned activities. Planned activities begin loosing ground and there is no paper trail left behind to defend why things are running late. Non-sanctioned what-if scenarios may be stealing time from your project, or even worse a potential change becomes a must have in the design teams mind and they begin work on tasks not in the plan. The business must drive the change process and design management must act as a gatekeeper to change. Without steps in place to manage feature creep design will be faced with unexplainable delays due to lack of clarity in feature expectations.

DESIGN DOCUMENTATION

Design documentation goes beyond the engineering specification to cover process related activities such as change management, best practices, simulation plans, design review requirements etc. I personally feel that completion of documentation goes a long way towards aligning the team, even if it is never read. Documentation

development will foster team alignment when and only if there is large group participation. If there is work to be completed for any project documentation there must be tasks associated with their completion as part of the project design plan.

DESIGN BEST PRACTICES

Defining how design work is completed within the team should be covered under the best practices umbrella. Coverage of the “how to” areas outside of the standard CAD/CAE design environment should be captured in this type of document. Consider the information must be defined for any design deliverable to remove the possibility of rework as the later integration of the design commences. If there is a procedural decision to be made, capture it here to ensure alignment across the entire team.

For schematics I suggest defining valid view types, page symbol generation requirements and valid reference library components to capture process options such as single or double poly caps. The PDK version to be use should be identified in addition to the specific the tools that will be supported for the project. Don’t leave out simulation expectations; include sim corners and temperatures to be run for both digital and analog designs in the project.

CAD/CAE

Designers tend to fight with tool related issues quietly and alone which leads to design activities taking longer than expected. Even worse, each designer dealing independently with a tool issue will amplify the total impact to schedule. Any expectations of the design tools and/or design flow should be defined and then validated to ensure the project plan includes completion of any CAD/CAE work before it is required on a real design. Making any assumptions about what will be available to the team, in the technology and methodology they will be using, will leave the team open for unforeseen problems with the tools. Identify

any CAD/CAE work required for the project, make it part of the project plan and then track the activity to closure.

Be relentless about the identification and closure on any open CAD/CAE tasks necessary to support the design flow being used on the project. Make a representative of the CAD/CAE organization a part of the team and expect them to be part of your routine design team meetings.

Design Ownership of Supporting Activities

Absolute clarity in the ownership of any of the supporting design activities is essential. If there are any assumptions made about ownership of supporting tasks, the project has opened the door to an unpredictability that will be certain to disrupt the plan. Organizations that assume design support activities are owned outside of design are opening themselves up for missed expectations. Ensuring the proper clarity and depth of supporting activities will only be accomplished if design identifies, defines and manages them as part of the design execution flow.

Managing the support tasks within a design organization falls within the scope of what I consider as the "design process". All of the activities, decisions and deliverables from a design team are part of an organizations design process. For example, the design flow is considered one of many sub-processes that make up the design process. A predictable design team will have a thorough set of supporting tasks that will be identified, defined, planned and tracked for each one of the sub-processes outlined in the landscape identified in Figure 1.

Summary

Formalize the identification of missing or unmanaged activities to find what is not known about roadblocks to ideal design execution. Ensure ALL design activities are a part of your design plan and manage them all to closure, within design. Teams that strive to manage all activities related to support of the design steps as well as the actual design steps themselves will reap the benefits of predictable design execution.

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