

## TI Increases End Customer Confidence with Numetrics Approach to Planning

### In Brief...

#### The Challenge

Develop accurate schedules and plans for extremely complex mixed signal SoC designs.

#### The Solution

Use Numetrics' ERP tool suite and IC project database to predict effort and schedule for all new and derivative IC wireless designs.

#### The Impact

The Numetrics planning tools provide an objective basis upon which to analyze new project proposals. The credibility of the schedules and plans based on the use of these tools enhances communication between marketing and R&D, and provides fact-based data in support of the sales process for a new design.

#### The Value

Increased schedule planning accuracy increase customer confidence as well as providing a more robust internal planning process.

Wireless System-on-Chips (SoCs) are among the most complex products produced by the semiconductor industry. These high volume devices rely on advanced process technologies, boast multiple cores for computing, communications and multimedia processing, and include state-of-the-art analog & mixed-signal (AMS) circuit blocks. The combination leads not only to design complexity, but also to challenges in resource planning and schedule estimation.

Texas Instruments (TI) is a world leader in the design of these leading-edge semiconductor devices. The proliferation of wireless standards and the explosion in demand for mobile wireless products creates a large market opportunity, but it also attracts competition. To win in these markets, TI must repeatedly deliver its products on schedule and within budget—to some of the most demanding OEM customers in the electronics industry.

Yves Nogues, an R&D manager in TI's Wireless Terminals Business Unit (WTBU), is based near Nice, France. His responsibilities include developing and promoting best practices across a wide range of WTBU's product development activities, including project planning, schedule risk assessment and design implementation strategies. WTBU numbers some 2,500 employees located in Bangalore, Dallas, Nice, Tokyo, and Tel Aviv. The organization accounts for a significant portion of TI's business. Its products include the well known OMAP™ application processing platform, modems, Bluetooth and GPS devices, and connectivity ICs. TI's silicon implementation technologies are among the most aggressive in the industry.

### The Challenge

As is the case for many semiconductor companies, TI promotes a culture of setting aggressive targets for new projects. This was a recognized pattern, and within WTBU there was a sense that setting aggressive targets—including both schedule and product features—not only aligned with its marketing organization's product release objectives, but also puts focus on achieving de-

velopment cycle time excellence. However, this practice also had its downside. Initial schedules had high variability and therefore lacked reliability, and aggressive targets typically had to be revised downward. Not surprisingly, initial targets often diverged significantly from final performance results. WTBU recognized that it needed a reliable method for quickly estimating IC project

resource requirements based on a target design spec and schedule, even if the spec was preliminary. Such a capability would enable its development teams to generate alternative schedule and staffing plan scenarios, which would aid decision-making. It would also strengthen WTBU's customer-engagement process, especially during the RFQ phase, by allowing WTBU to present the customer with a complete range of project scenarios.

The tipping point for WTBU to take action came as a result of a thorough market analysis, in which it discovered that some of its competitors were delivering chips faster and at potentially lower cost. WTBU management concluded that outflanking its competitors would require WTBU's development teams to execute on their most aggressive project plans. That demanded project staffing plans aligned precisely with the product's design complexity and schedule constraints. Mismatches would translate to missed cycle time targets, which was unacceptable. Not only would resource estimates need to be accurate and reliable, estimates needed to be developed during the earliest stages of the project lifecycle. Each product development initiative would need a full range of possible scenarios, dictated by alternative feature set and performance specs. It was a major challenge, but one that had to be met.

### Primary Outcomes

Nogues set his initial goals for the Numetrics solution as follows:

- Better schedule and milestone predictability
- More reliable commitments to the marketing group
- Eliminating major changes in schedule and staffing plans due to inaccurate estimation
- Consistent processes and metrics
- Developing clarity about as many planning variables as possible, as early as possible, by accurately quantifying them (e.g. design complexity)

These goals have been achieved. Nogues observed, *"the output from the Numetrics tools are considered highly credible within TI's Wireless Terminal Business Unit. Design and program managers now accept that the inevitable randomness associated with new IC development projects can be statistically modeled, using past outcomes and events to predict future results."*

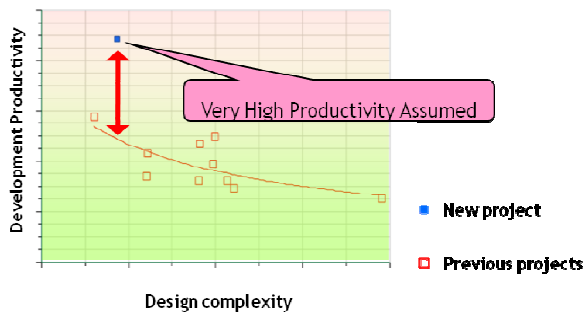
*"Program managers now come to me because they want to know what the tools predict, both as a check on their own assumptions and as a way to better understand their new project,"* he explained.

Operationally, WTBU now uses the tools as a standardized part of project reviews and as an integral part of its product development and business processes, pulling reports directly from the Numetrics software. This is valuable again because it increases the objectivity of such reviews.

### The Unexpected Bonus

Like most semiconductor organizations, TI's WTBU seeks a customer-partner prior to funding a major development effort. One of the purchase criteria for such a customer is a credible schedule. WTBU has found that presenting the detailed information available from Numetrics' IC Planner tool provides objective evidence of the credibility of the proposed schedule and is a powerful way to increase customer confidence, even before development has started. This becomes a valuable addition

to the sales process because it increases the likelihood of achieving design wins sooner and more often. It works by mitigating one layer of uncertainty from the TI design proposal, by demonstrating that the productivity required to meet the schedule is in the range that has been achieved historically by teams at TI. If the productivity assumed is out of range, corrective action is taken (see Figure 1). “By incorporating the results from Numetrics planning,” explained Nogues, “we can give our customers confidence that they can plan the entry of their products into the market knowing that our schedule is well thought through and achievable.”



**Figure 1:** Texas Instruments’ WTBU organization can quickly quantify the schedule risk associated with a new IC development project, relative to its past projects and/or to the semiconductor industry.

## The Process

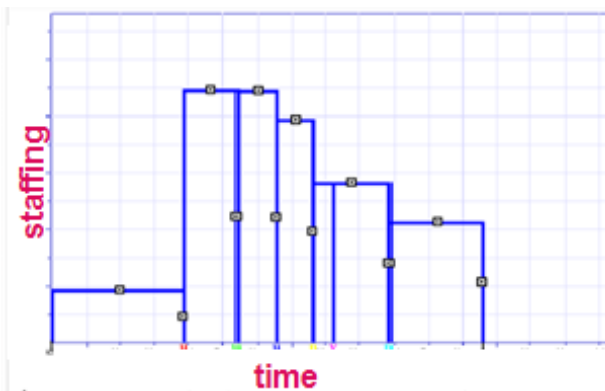
Yves Nogues and the WTBU Team introduced Numetrics first as a robust solution for creating a database of its previous design projects. He explained, “This was important because it provided a starting point for estimation for new projects. We believed that an accurate database of previous designs would greatly enhance our project planning process, eliminating unrealistic schedules and enabling a more fact-based and substantive dialog between R&D and marketing around cost, schedule, and feature set.” Nogues was confi-

dent this was achievable, based on his previous experience with the tools.

As WTBU’s database grew, users and managers within TI observed the power of an accurate and fully normalized historical baseline against which to compare new design projects. WTBU’s willingness to support accurate data input therefore continuously improved, and there is now high confidence in the quality and value of the data. Within WTBU, the planning tools and their inputs & outputs are overseen by the program managers. These engineering managers focus on overall project success and, therefore, are highly motivated to ensure the quality of data entered into the system.

New projects are entered into the Numetrics software, and plans are synthesized using algorithms specific to chip development, which include a normalized calculation of design complexity. This aligns well with TI’s planning process, which involves building a block diagram of the chip at quite an early stage and using this as the basis for the plan. “By working this way, our design teams are able to match their experience and intuition with the block-level complexity ranking generated by Numetrics’ IC Planner tool,” Nogues added. “Coming out of this process, we have enough information to make decisions about sources of IP, the level of re-use, and a number of other factors.” In addition, easy “what-if” analysis encourages exploration of design strategy execution, including generating a full range of scenarios based on different features, functions, as well as staffing and schedule constraints that can be applied by using the IC Project Planner tool (“Planner”).

Planner estimates key project milestones and staffing needed in each project phase. The synthesized plan shows the time and duration of each phase of the project and a breakdown of each role on the project (see Figure 2). A viewing tool enables users to compare the results to past completed projects. This helps identify major differences in execution assumptions. TP's experience is that by identifying major differences early, users have the time needed to perform more detailed analyses that lead to decisive corrective action, therefore saving money and time.



**Figure 2:** TI-WTBU fact-based synthesis estimates the staffing and duration for each phase of a new project, based on a calculation of its design complexity and estimate of the anticipated development productivity, which is guided by performance from previous projects stored in the TI project database. Also presented to the user is a breakdown of the staffing required by each role on the project during each phase (i.e. logic designers, verification engineers, analog and RF specialists, etc.) The user can alter staffing and/or duration for each phase between two milestones and see the effect both on the phase itself and the overall plan.

Execution assumptions of the new project are compared to historical project performance. This allows the new design to be seen in the context of other relevant TI designs and enables TP's project plans to be aggressive—but achievable. Any unusual aspects of the project plan are easy to identify through this straight-

forward comparative process, which is directly supported by the analysis and reporting tools within the Numetrics suite. This is how TI-WTBU systematically performs quantitative schedule risk analysis: the new project's plan assumed productivity, based on its design complexity and staffing, is compared to actual achieved productivity on past projects, as shown earlier in Figure 1. Users can instantly see if there are unacceptably large gaps, which translate to high schedule risk, on charts directly generated by the Numetrics software. If the level of risk is considered too high, the next step is to compare the assumed duration and staffing for each project phase with Numetrics' fact-based plan.

This fact-based planning defines a realistic initial plan, which provides an envelope for the manager to create a “bottom up” plan. The two eventually converge into a fully optimized project plan – optimized for schedule, staffing, product features and assuming maximum achievable productivity. Figure 3 shows the fact-based plan compared to an initial version of Nogues' bottom-up plan.



**Figure 3:** The ability to very quickly create a fact-based synthesized plan that then drives the manager's bottom-up plan enables managers to readily observe potential areas of resource shortage and eventually reconcile the two plans.

### Summary

Semiconductor organizations, such as TI's wireless terminals business unit (WTBU), face stiff competition in the multi-billion dollar global market for wireless ICs. Winning demands best-in-class development schedule predictability, the shortest possible cycle times and delivering chips with the right set of features and functions. Today, Numetrics' software and databases play an important role in enabling WTBU to achieve these goals. These tools enable its development teams to generate reliable estimates of resources, schedule, design complexity and schedule risk. Equally important, TI is able to create aggressive, but achievable, project plans which means that projects are staffed at the lowest possible cost.