Open IP™ – Rethinking the "Build-or-Buy" Decision

An ADI Engineering Whitepaper

ADI Engineering's unique "Open IP" approach allows OEMs and Systems Integrators to balance the key issues in product development

Part II: Customization and *Open IP*

In Part I of this two-part series, the fundamental concepts of the build-or-buy decision and the elements of *Open IP* were discussed. But, how does all this relate to specific development efforts? What are the most important development issues? How much customization, if any, should a new product design incorporate?

Every successful new product is unique in some aspect. In high-end electronics products, uniqueness is typically defined by the twin attributes of an increase in features with a decrease in cost, relative to competitors. In fact, an oft-repeated refrain amongst marketing managers for consumer electronics products is that new product introductions must occur every year with at least twice the capability in features at half the cost of last year's model.

While vertical market segments such as military, industrial, medical, etc. may not move as rapidly as consumer electronics, OEMs in these markets still derive their greatest successes when they promptly release new products with more features at lower cost, a fundamental concept represented by the "cheaper, better, faster" refrain from Part I. Customization – and more importantly, the decision on what to customize – plays a huge role in a product's potential success. If handled properly, customization can greatly reduce development risk, time-to-market (TTM), and cost, while improving performance and feature sets. If handled improperly, customization can increase costs, reduce quality, and cause development delays.

Part II of this whitepaper series evaluates the customization process as it relates to *Open IP* and the decision-making associated with customization.

Standard or Custom – Approaches to Developing Electronics Solutions

When it comes to the electronics solution inside a new product, the utilization of an off-the-shelf Single Board Computer (SBC) merits significant consideration to improve time-to-market and quality. Because the value-added IP or other "secret sauce" that any OEM adds to its new product typically is not dependent on the design of the general-purpose microprocessor-based circuits on the SBC itself, utilizing a third-party SBC in either its off-the-shelf form or semi-custom variant allows the OEM to focus their R&D resources on implementing their own core value proposition. Development of a new SBC design is reserved for those instances where the uniqueness of the feature set requires it, or where high production volumes yield a positive ROI on a new SBC tailored to the application.

In ADI's experience, production volume is the primary factor OEMs consider as they decide whether to use off-the-shelf SBCs, or a fully- or semi-custom hardware solution. Higher production volumes are more sensitive to unit production costs, potential profits are higher, and R&D budgets are larger, so the ROI equation favors customization. Conversely, smaller volumes

are usually less unit cost sensitive, and the ROI equation favors the use off-the-shelf SBCs and overall minimization of development costs.

There are typically three categories in this build-or-buy equation:

- **Low Production Volume:** At low quantities, R&D budgets are tight and are focused on the OEM's own value-added IP. Standard off-the-shelf SBCs and enclosures are the appropriate choice for quick time-to-market. Customization is limited to the "glue" necessary to integrate the SBC and enclosure into the overall product design, even though the resulting unit costs are not fully minimized. Such customization items may include cabling, daughtercards, adapter interfaces, driver- and application-level software, etc.

- **Medium Production Volume:** As production quantities and R&D budgets grow, OEMs can consider the benefits of greater customization – a better-targeted feature set resulting in lower production costs and a sleeker, more focused product implementation. The design of a standard SBC can be incrementally updated to add or remove specific components and customized enclosures can be form-fitted with the electronics solutions.

- **High Production Volume:** The highest-volume products often have R&D budgets sufficient to develop a fully custom electronic solution optimizing production cost and feature set for the OEM's specific application.. However, design risk and complexity, shrinking time-to-market demands, and quality/repeatability issues increasingly make the full custom hardware option less attractive to many engineering managers.

As discussed in Part I, OEMs situated anywhere in the continuum between low and high production volumes maximize their efficiency in the build-or-buy decision with ADI's *Open IP* model by taking the best of "build" coupled with the best of "buy" in choosing how to develop electronics solutions. Since the *Open IP* model reduces many of the traditional costs and risks associated with both off-the-shelf SBCs and custom solutions, ADI fundamentally rebalances the build-or-buy decision to benefit OEMs at any point in the "build" to "buy" spectrum.

Leveraging the ADI Design Methodology with *Open IP*

In tandem with the total access to ADI Engineering's SBC designs that *Open IP* provides, ADI has created a highly efficient and proprietary Design Methodology through its 20 years of experience in designing embedded systems. The *ADI Design Methodology* (ADM) is employed uniformly for all design efforts, whether internal R&D projects to develop new off-the-shelf SBCs or externally defined OEM customization projects.

Unlike typical design houses that rely solely on billable engineering hours, ADI had to satisfy its own critical business need as a volume SBC vendor in creating a repeatable, efficient, cost-effective Design Methodology whose success is not viewed in its ability to generate engineering revenues, but rather in its ability to simultaneously achieve design excellence along with very low TTM and cost. And unlike traditional OEMs and ODMs, ADI had to ensure that its Design Methodology was flexible enough to allow customization for a wide range of customer requirements. The end result, ADI's proprietary *ADM*, allows OEMs engaging ADI in semi- or full-custom designs to directly benefit from the same unique Design Methodology that ADI has used to create its own industry-leading SBCs.

ADM emphasizes design consistency and re-use, defining specific phases and gating processes. Through constant refinement over the years, *ADM* has been honed to provide a balance of system analysis, design, design review, testing, certification, and production-readiness within an overall project/budget management architecture. *ADM* is flexible and can be adjusted as necessary based on the OEM's requirements. For example, an OEM of a critical military electronics solution may require a higher-level of environmental testing than an OEM of a consumer electronics device. In general though, the main phases of *ADM* are:

- **High-Level Design:** In this early system analysis phase, overall requirements and specifications are delineated and the project budget and schedule are defined. Additionally, architectural design is completed and functional partitioning and functional design specifications are finalized.

- **Detailed Design:** A complete design validation plan is created as well as detailed electronics and mechanical hardware and software designs are completed, subject to design reviews. Best practices for regulatory/certification testing and design-for-test are employed.

- **Alpha Integration and Test:** Initial prototypes are built, tested, and validated, including integration of electronics, software, and packaging components. A beta test plan is completed.

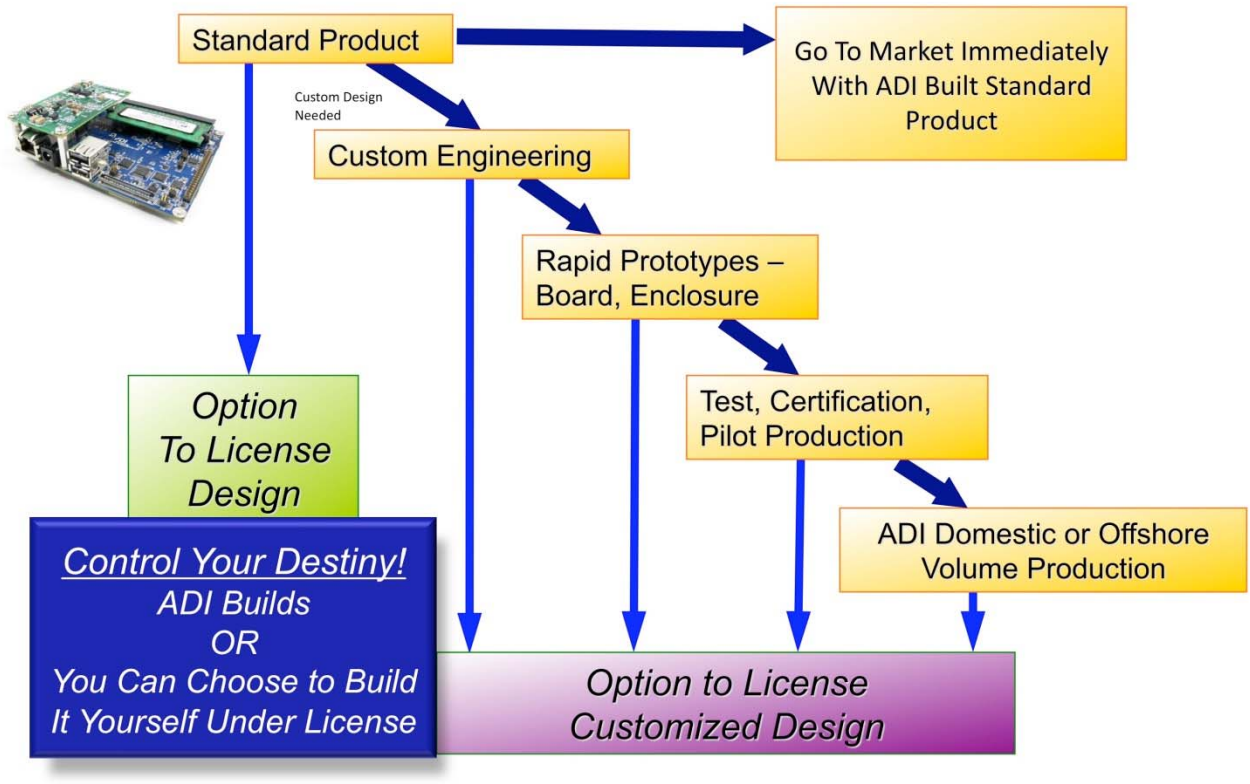
- **Beta Test:** Initial low-rate initial production (LRIP) and testing is initiated and completed, along with regulatory/certification testing. Production yields and a reliability analysis are completed, appropriate production/support personnel are trained, and the complete design is released to manufacturing.

- **Volume Production:** Along with production manufacturing, continuing engineering, technical support, and design feedback are implemented along with ongoing yield analysis and production enhancements.

Customization and *Open IP* – ADI's Solution to "Cheaper, Better, Faster"

Backed by *ADM*, ADI's expert customization services, efficient manufacturing capabilities, and flexible *Open IP* licenses allow OEMs to get the best of all worlds in designing and implementing their electronic products. Customers using ADI's off-the-shelf SBCs benefit from having complete production control and IP ownership opportunities, removing critical third-party dependencies inherent with traditional SBC vendors. When semi-custom or full custom SBCs are needed, ADI's strong and deeply experienced hardware and software engineering teams are able to engage in a range of customization services, supported by industry-proven, and high-reliability off-the-shelf SBC designs and our unique *ADM* approach.

In summary, ADI delivers industry-leading design quality and robustness while reducing time-to-market and design risk. And, with a worldwide network of manufacturing facilities able to handle low and high production volumes, ADI's production services offer cost and quality levels frequently unavailable to OEMs, while seamlessly handing the substantial hidden costs and risks of volume manufacturing. All the while, OEMs retain ultimate control of the IP they are using and the production of their products, and are free to take advantage of ADI's unique *Open IP* model to directly manufacture or modify ADI's off-the-shelf products, or semi- or full-custom solutions created by ADI for their unique application.



For more information on *Open IP* and *ADM*, please contact ADI Engineering at info@adiengineering.com.