

“Glue-ware” Essential for Streamlined SOC Execution at Emerging Fabless IC Companies

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Emerging Fabless companies usually have “system-level” ideas that need to be transformed into silicon. The end product is an integrated circuit (IC) or a chipset that is sold to an OEM or end system provider. The company’s business success is dependent on selling such SOCs (systems on chip).

At these companies the initial focus is generally on design related activities. Supply chain- and Operations-related issues are not in the forefront. The following are some of the design related focus areas.

- a. reducing the algorithm/architecture into an IC spec and RTL
- b. “proof of concept” validation with potential customers, sometimes thru an FPGA implementation
- c. verification of the functionality, ASIC design execution and timing closure
- d. physical design and GDSII tape-out

A general perception is that once these design activities are completed, implementation of the post-gds prototyping and manufacturing (Fab, Assembly, Test) tasks are a “slam-dunk”. There is a big “sigh of relief”. This could not be farther from the truth. Actually this is usually only the half way point of the marathon. Over 50% of the Time to Money is yet to come! In fact this “Operations” area is not a core competency of the principals, yet the business success of the emerging company depends on successful execution in this area.

Individual suppliers in the Design (IP, Libraries, IO, Memories, Design Services providers...) and the Manufacturing (Fab, Assembly, Test,...) supply chains usually have the best solution in each of their spaces. However, the experienced, Vertically Integrated Device Manufacturers (IDMs) and mature Fabless IC companies recognize the existence of GAPS in the overall development and manufacturing of the IC. “Glue-ware” is defined as the proactive recognition and plugging of these gaps. A comprehensive list of potential gaps, pitfalls and the associated solutions will be addressed in a forthcoming paper.¹ The authors believe that a significant fraction of industry problems such as design tapeout delays and re-spin rates can be attributed to the existence of such gaps.

Unfortunately it is also true that some of the early decisions can accentuate the gaps and can come to haunt the companies especially in the Operations phase.^{2, 3}

- Did you pick the right technology? Is it mature enough to provide the expected yield?
- Can you meet the expected cost goals?
- Did you pick the right IP provider and were you able to negotiate a favorable business deal?
- Was the IP validated in the right process technology at the selected fab?

- Did you have the right business relationships with the supply chain partners – fab, assembly, test,...?
- Did the chip size grow from the original plan?
- Is the wafer price competitive? Packaging price?
- Is there a Test house you can use for test development and production test?
- Does your testability scheme provide sufficient Observability to allow efficient debugging of the IC, if there is a problem?
- Was the ESD protection adequate?
- Can you meet your customer's Quality and Reliability requirements?
- Can you migrate your design to a different Fab for second Sourcing?
- And the list goes on

In this context Operations has a fairly broad definition as follows

- the infrastructure and support required to bridge the gaps between design and manufacturing.
- the “glue-ware” required for smooth execution through design, prototyping and manufacturing.

Unfortunately in many cases such Operations functions are addressed by Emerging companies in an ad hoc manner and decisions are sometimes based on limited information and hear-say.

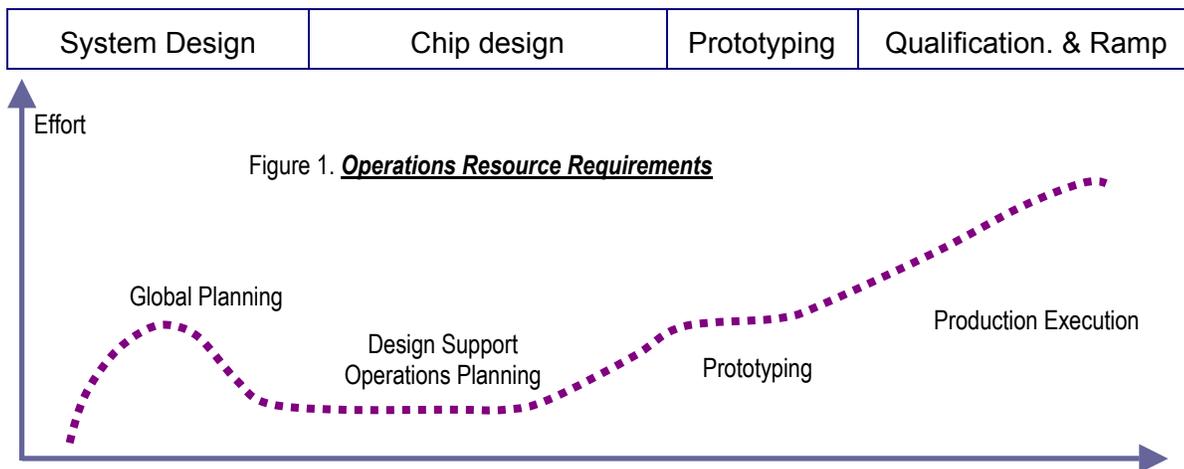
The Operations Dilemma

While experienced principals may realize the value of some of these Operational issues, they do face a dilemma.

- Hiring operations people too early can be expensive
- Hiring them too late can be catastrophic in terms of getting the chip thru Ramp-up and Production

Recommended Approach

A systematic methodology to account for some of these operations issues has been developed. This is based on a concurrent engineering approach which is one important aspect of the “glue-ware” in the IC development and implementation process. Operations tasks are organized into four phases of the IC life cycle – Global Planning, Design Support and Operations Planning, Prototyping and Production Execution (Figure 1). This approach offers an opportunity to cost effectively manage the Operations Dilemma by selectively leveraging experienced industry resources.



Early Global Planning is an investment that goes a long way in minimizing surprises in the manufacturing phase. What is unfortunate is that such global planning is rarely implemented even though the amount of effort required for such planning is relatively small compared to the design resources being invested by the emerging company. The manpower investment does not need to be a full time role. What is needed is an experienced team with the requisite skills to understand the design requirements and match them up with the right execution solution. Adequate attention to Operations issues during the design phase allows for sufficient planning to allow a smooth transition to prototyping and production. There is a burst of activity in this phase - the resources required are minimal (1-4 man months) but essential and are usually senior, experienced individuals. The focus here has to be on the breadth of the issues that need consideration – design, including methodologies and tools, models, IP, libraries, memories, IO, process, packaging, assembly, test, yield, debug, business issues etc. The breadth of the team’s experience is key to providing “glue-ware”.

Unfortunately, systematic Global Planning is not usually done because of some or all of the following reasons.

- a. the principals are in a hurry to get started with the design
- b. the right people are not available
- c. there is a perception that Operations tasks can be deferred till later
- d. a “superficial” comparison with the industry norm indicates the right approach
- e. there is an under-estimation of the complexity of the tasks

In our view the industry is beginning to recognize the value of such proactive focus on Operations activities.^{2,3} The most attractive approach is to leverage a reputed Virtual Operations team that is in the business to provide such services. Required elements of the team’s strengths are:

- **technical skills** in understanding the design requirements and matching them with the manufacturing technologies and the supply chain
- **business experience** in helping make the right trade-offs, establishing and making connections with a solid supply chain including IP providers
- **program management skills** to define a project plan that is aggressive and yet achievable

Such a Virtual Operations team serves a crucial role in the selection of the right service providers – both for the design and the manufacturing phases - and also in the “make/buy” decision for an Internal Operations team.

A sub-set of the Virtual Operations team can be used to provide support in the Design phase. This duration is longer and can be 6-12 months depending on design complexity. The resources required are usually small – about one equivalent full time person. However many different skills can be required at different times during this phase. Leveraging an experienced Virtual Operations team can make available the right skill at the right time. A more detailed description of the activities and the skill sets required is the subject of another paper.¹ One major goal of this phase of activities is to develop a detailed Operations Plan including implementation details for chip prototyping, qualification and the ramp into production. This must include “make/buy” decisions, a hiring plan and execution of contracts and business relationships with the supply chain partners.

Finally, the resources needed to support the qualification, ramp and production will increase to a full operations staff needed to manage the supply chain and sustain the I.C. in production. Emerging companies have many choices in the execution of these phases. “Glue-ware” is essential and can be provided by the appropriate Virtual Operations team to varying degrees depending on the supply chain implementation model that is adopted. As the company grows it will likely want to consider building an Internal Operations team. The right Virtual Operations team should play a key role in the planning and staffing of such an internal team.

It is important to note that such a Virtual operations team complements services provided by Fabless ASIC suppliers such as eSilicon in the prototyping and production phases. The Virtual Ops team can be thought of as a strategic partner and an extension of the Fabless IC team that helps formulate and launch an Operations Strategy.

It is also important to note that the Global Planning activity can be very helpful even for the Emerging Fabless companies that choose to implement their ICs using the traditional ASIC sourcing model – an RTL or Netlist hand-off to an ASIC supplier such as LSI Logic.

Conclusion

Emerging companies can leverage a Virtual Operations model to cost-effectively manage their SOC development and implementation. The more distributed the selected supply chain the more important it is to leverage this recommended approach for accessing the “glue-ware” that is essential for meeting schedules and the overall business objectives.

References:

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