NOTES ON UOP

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I'm trying to make sense of the technical agenda under various UoP scenarios. Seems like we are rapidly embracing a path which compromises technical success in favor of getting funding (er, at any cost).

Three Levels of Funds

1. $10M for ~15 months
2. $3M for ~8 months
3. $100K-650K seed round (nominally $300K)

Success Criteria

All scenarios require follow-on funds. When the original funds are close to depletion, some sort of criterion will be applied to determine if follow-on funding is appropriate. The criterion will be stated in terms of meeting the goals or objectives for the initial funds.

$10M -- development of customer sample chips
$3M -- first silicon run and evaluation
$300K -- technical and market feasibility of a product

Main Point

A $3M funding round increases rather than reduces investor risk:
-- no well-specified and productive criteria for success
-- no opportunity to build for other mandatory execution areas
-- constant threat to solidity of Company
-- unnatural and stressful timing of follow-on decision
-- no technical decision point
-- technical risk is best reduced by <$300K feasibility study

Discussion

I assume that all plans have a strong component of long-term viability, however only the $10M level provides resources for a long-term plan.

Developing a viable Company requires execution in several areas. These include (not necessarily independent areas)

- a technically feasible product
- a marketable product
- a corporate and management infrastructure
- a fabrication infrastructure
- a sales and marketing infrastructure
- a technical infrastructure

For the level of execution we are proposing in our growth and market-share plan, all of the above areas must be developed in concert.

$10M Scenario

We have put together a 16-24 month UoP plan which builds all execution areas. The evaluation condition is our ability to attract customers. Follow-on funds would be predicated on obtainable sales orders.

Success requires the following, all of which are built into the budget for this scenario:

• technical development of a product which attracts customers. We need the first product to be completely designed so that its price and performance are known. Complete design means
  -- a fully functional hardware product within fabrication cost parameters
  -- fully functional design and configuration software
  -- completed tech docs, product spec sheets, user manuals
  -- fully defined customer needs, requirements, and preferences

• technical capability for innovative design with many decision points
  -- balanced expertise
  -- smooth tech decision-making
  -- appropriate resources and adequate staffing
  -- strong tech infrastructure support
  -- strong in-house software tool development
  -- fabrication lead-time

• corporate capability for large scale fabrication and delivery, which requires
  -- a well developed plan/process/capability for manufacturing in quantity,
  -- a well developed support structure for potential customers
  -- developed marketing and distribution channels

• corporate capability to sustain growth and product production
  -- a sound corporate management structure
  -- sufficient size and stability to support moving into
     large-scale manufacturing
  -- market and competition analysis and understanding
  -- strategic partnerships

$3M Scenario

The goal would be to provide a decision point for further funding. A main question is identifying a criteria which is not completely disruptive of technical flow. We have assumed that all execution areas would continue growth. A main question is allocation of limited resources.

Discussion

Our current model assumes that this level would slow down growth by a few months. I believe it would also undermine our long-term objectives. If we remain slim prior to first silicon, we can set an evaluation point, at the cost of having little supportive infrastructure or momentum for coming to market. The slowdown of this plan is not in the first six months, it is in the second six months, a far more vital time for determining success. We all acknowledge the stress that the lack of funds at the 6-8 month point would place on the Company. This intuition is knowledge that is too expensive to ignore.

This plan has inadequate technical staff to deliver the goal, undermines the idea of stable growth, and does not contribute to risk reduction.

Aside: Here's a pragmatic impact. Funding for 7-8 months only does not provide sufficient incentive or security for any Seattle people to move to SF. All of these hires are not available until the July time-frame. Should we begin on say April 1, we are saying "Move your homes, we can support you for four months."

Criteria

After initial feasibility designs, we will encounter *many* design decisions, most of which are driven by market, cost, development time, and other not purely technical factors. The product performance and configuration will be selected from a wide range of design decision points. This will require fully functional corporate capabilities across all execution areas.

Technical design intended for silicon fabrication includes

- -- simplified architecture for first spin evaluation
- -- extensive pre-silicon testing of design
- -- extensive consideration of chip features and integration
- -- alpha completion of user software
- -- extensive development of in-house design software
- -- deep knowledge of market and competition
- -- tech staffing and resources to cover all areas

The impact of these design decisions (and supporting optional routes) will not be known until after several design iterations, and exploration of market acceptance. The iterations will substantively change all product features and performance metrics, as we converge on a solution which is cost effective and marketable. Although design iteration will continue to tighten performance and cost estimates, there are only a few natural technical divisions which provide differential knowledge:

STEP	*MONTH*	*COST (K$)*	*FOR*
1. Feasibility study	1-2	100-200	consultants
2. Design candidates	3	400	staff and tools
3. Design simulation	4-5	400	"
4. First silicon	8-9	600	staff and fab

Costs are for tech only. Concurrent execution area development is necessary. Here are the allocations in our current plan for which $3M gets us to month 9:

ROLE	*BUDGET K$*	*FOR*
Executives	370	long-term infrastructure
Hardware tech	364	product design
Software tech	153	design and systems support
Marketing	98	product definition
Tools	475	
Fab	200	
Overhead	221	
Legal, services	118	
Marketing	65	
Month 8 hires	27	
Consultants	33	
Travel	68	
SUM	2200	

Notes:

-- No software staff for building EDA user tools.
-- Insufficient design staff for first fab run
-- Insufficient marketing staff for design decisions
-- Executive top heavy unless long-term is secure

We are proposing to bring an innovative custom design from scratch to fab (as well as build a Company) with four hardware folks in 8 months. Conventional wisdom is ten designers over 18-24 months. [My problem is that we want to do this without sufficient long-term funds.]

Where in this tech flow is it appropriate to place a funding evaluation? Certainly after feasibility analysis. Prior to first silicon, no simulations are likely to provide a substantive decision point. First silicon is the decisive proof step. However, due to lack of design time, first silicon will not be able to address chip-level issues.

If we develop concurrent execution areas, the company will be accelerating into marketing and product refinement. This is not the time for a "stop to decide whether or not to continue".

To emphasize: prior to first silicon provides little differential information (other than ability to execute for several months). After first silicon is when to *sprint*, not step back to evaluate.

First silicon should be postponed as long as possible, so that the design will be close to stable prior to large fab expenses. Our current UoP adopts a different strategy, that of rush to silicon to meet funding constraints.

I wish to be explicit: we have ignored the advice of all tech consultants on the issue of architectural design and effort. The danger is that this $3M scenario will embody this risk, assume it not to be a risk, and then add more risk on top (such as even tighter schedules with fewer support resources).

Prematurity Errors

Our chips are full custom designs, since a novel architecture will not fit fab libraries. Either we allocate the 12-15 months for this, or the first spin will be information-gathering only.

This scenario does not develop our software, either in house or for first customer evaluation.

Steps for Technical Development

1. Infrastructure:
   -- hardware and software development tools
   -- technical personnel
   -- corporate
   -- execution area department growth

2. Cell-design: This is known to take 12-24 months to perfect.
   The sequential approach is
   -- design a rough functional model with estimatable performance parameters
   -- transistor-level simulation of the model
   -- first spin silicon and performance evaluation
   -- iterative refinement over several years

3. Chip design: This is known to be prerequisite to any other technical progress. The steps:
   -- design a rough functional model of the core
   -- design a strawman functional architecture without support functionality
   -- market analysis to identify support features
   -- rough total chip architecture
   -- HDL encoding of architecture
   -- simulation and evaluation of rough architecture

4. System design: Integration into existing boards and products requires extensive customer, market, and application knowledge.

$300K Scenario

The objective is to deliver sufficient technical design specifications to encourage further investment. We assume that marketing and management do not require substantial funds to validate capabilities.

I'll specify the steps and costs for meeting any convince-me scenario.

1. Fill-in available technical knowledge to be able to make a responsible plan.
   -- cell design: 8 hours
   -- chip design: 16 hours
   -- system design: 8 hours

2. Rough cell design for rough performance estimation: 80 hours

3. Rough chip design, in concert with cell design: 80 hours

4. No system design or market feasibility

Total consultant cost: less than $50K

Deliverable: estimated performance characteristics of two architectures
   -- processing speed
   -- logic density
   -- power requirements
   -- cost and resource estimates for full design

The deliverable provides feasibility information, but all design specifics are throw-away.

Prematurity Errors

-- Hiring technical personnel:
inappropriate commitment for level of funds
use as consultants for employment evaluation

-- Designing a product
too early to commit to architecture, features, performance levels
no market analysis

-- Building a Company
too high risk to get follow-on funding
unknown results from technical feasibility