NBA 6120 – Fall 2015

Draft of Case Study #1

Business Strategies for Semiconductor Industry

In previous lectures I have roughly categorized the growth of digital environments into three fifteen year generations, each benefitting from a 1000x increase in transistor density on the manufactured integrated computer chips. The first generation (1965-1980) could be considered the Era of Timed-Shared machines, where the economics made it necessary for very expensive centralized computing facilities to distribute their costs over many users by time-sharing. By the next generation, the Era of the Mini-computer (1980-1995), the machines were sufficiently powerful to be able to satisfy the needs of many industrial and academic laboratories, ones which were already partially constrained by the lack of internet bandwidth. The third generation, (1995-2010), the Era of the PC and the Supercomputer, disrupted the mini-computer business (workstations, desktops, and high end laptops) as the new PC's could perform most calculations except those which had enormous scientific and data intensive requirements.

During each of the previous three computing generations, we have witnessed a steady increase in the capabilities of the client computer forcing the paradigm shift to the next generation. Many of the improvements were dependent on the roughly thousand-fold increase in processing power, ultimately enabling the shift to the new paradigm. (Although the exact time is not important, let us assume that we are now five years into the fourth generation, (2010-2025), the era of Cloud Computing and Mobile devices such as tablets, phones, and the Internet of Things (IoT).

But today we are witnessing a different situation. Although Moore's Law will most likely be slowing down (a predicted doubling in transistor density every two or three years), processing power may no longer be the driving attribute for the next generation, "always-on" devices demanded by the masses. Watts may already be more important than Flops, but memory size, video and graphics, screen size, ease of use, design, and the availability of bandwidth are all increasingly important. And of course, not to mention cost!

The economics of the semiconductor industry has also changed dramatically. Looking backward at the historical trends, even though total revenues may be increasing, we note that sales prices (ASP's) are dropping, "product shelf-life is decreasing", margins are getting lower, and revenues have shifted so that the dominant portions now are derived from mobile segments as contrasted to enterprise segments. And all of the above phenomena are occurring at the same time that fabrication plants and equipment costs as well as research and development expenses are increasing at such a rate that only a few companies with very large market share can afford to keep pace with the new technologies.

With these observations, should the major players involved with the design and fabrication portion of the semiconductor industry (Intel, Samsung, ARM, TSMC, TI, Qualcomm, etc.), be questioning their business model for the remaining decade of our current fourth generation environment? Already only a few companies can compete! Already we are reaching the market's economic pricing barriers before we reach the technology barriers! Recent publications have implied that we are using the wrong criteria for decision making! Maybe it should no longer be Moore's Law (transistor density/chip) which historically has driven the decisions, but the cost/chip. With the enormous costs

necessary to move to the next generation process technology, have we not reached this minimum several process technologies ago?

You have been asked by company X's Board of Directors to prepare a document which considers changing the company's historical business model. Should the company build new fabrication plants and design and manufacture their own proprietary chips? Could the company maintain its leading process technology yet manufacture chips for its competitors? Should the company partner with another firm to protect its existing strategy by vertical integration? Or should there be some combination of the above?

Deliverables:

- 3-4 single space pages of text enumerating your rationale (printed)
- Print out of power point slides (graphs, tables, etc.) to present in class (2 slides per page)

Discuss all technical issues, assumptions, rationale, projections, (no actual numbers), market share, impediments, etc.

Groups should consist of three members.

Assigned: Sept. 9, 2015
Due: Sept. 23, 2015 (at the beginning of class)