

Not a mellifluous march to maturity

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..... A couple years ago, former Hewlett-Packard CEO Carly Fiorina proposed merging Hewlett-Packard and Compaq, even in the face of opposition from the HP heirs. She argued that the maturity of the computer market necessitated such a change. More recently, Oracle CEO Larry Ellison foresaw maturation in his market. It too was justification (in his eyes) for his hostile takeover of PeopleSoft.

In two recent events, executives also raised maturation as an issue to justify their action. IBM's executives decided to divest the company of its PC division, in this case to Lenovo. Motorola's executives decided to spin off its IC division, starting a separate company called Freescale.

What a tower of babble! The seemingly same—maturity—justifies quite different actions, both divestment and merger. Is this muddled thinking or substantive strategic logic?

There are two drivers behind this puzzle. One is sloppy semantics. There are three distinct types of maturity—technical, market, and organizational—and they neither relate to one another in a straightforward way nor do they relate to restructuring. That obscures a second and deeper problem. Restructuring can lead to bitter losses for employees.

What is technical maturity?

Technical maturity describes the rate and direction of technical progress along an experimental frontier. At one extreme, mature technologies evolve along pre-

dictable and incremental trajectories. At the other extreme, technologies are like adolescents: They develop quickly, laden with episodic moments and unexpected details. The difference between desktop computers and ICs broadly illustrates the point.

For almost two decades, the standard descendent of the IBM PC has acted as a template for the design of desktop PC hardware. It has not undergone dramatic change since a set of assemblers rebelled against IBM's PS2 designs in the mid-1980s. The last major design changes in hardware coincided with the creation of new market niches, the laptop and the NT server. The "sub-\$1,000 PC revolution" in the late 1990s was just less of the same in desktops at a cheaper price.

To be sure, even if desktop PCs are a mature technology, they are not a static one. The motherboards and hard drives became more efficient and so did the screens and software. The Universal Serial Bus is also convenient.

Yet, none of these changes are *surprising*. Nobody except the design fanatics at Apple—and bless them for their perseverance—believes PC hardware design has any *unexpected* leaps of functionality in its future. In that sense, the hardware technology has become established.

In contrast, for decades IC manufacturers have generated better performance in the final product. It was predictable only at a broad level. It involved shrinking the size of circuit line widths on wafers, improving yield rates after installing better

photolithography, using different chemistry in etching, and employing new materials layered together on the wafer.

Yet, the details were frequently surprising. Despite best efforts, the industry road maps never forecast the details correctly at three-to-five year intervals. Although technology historians find no obvious break in Moore's law in the last couple of decades, the reasons for its continuance *change* from one half-decade to another. Said succinctly, IC technology still displays unexpected advance.

To be sure, ICs display more technical maturity today than they did in, say, 1967. However, they still have a ways to go before becoming as technically predictable as PC hardware.

What is market maturity?

Market maturity never emerges overnight, so it can be difficult to recognize. This notion highlights the difference between predictable and reliable, and between unexpected and sudden. In other words, markets mature when returning users, instead of new users, dominate demand.

Early in a technology's market life, users will not know what aspects of a technology to emphasize in their own use, and, accordingly, will not know how to obtain more value from available suppliers. They will experiment and their behavior will be difficult to forecast.

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Eventually—potentially after a very long time—a new majority emerges with different features. Experienced users return to established channels, looking for replacements or upgrades with known features. The market appears stable as suppliers plan for this predictable demand.

Allow me to illustrate this point with a succinct summary of a complex historical trend. The PC is essentially a 1975 commercial invention. It coalesced around the IBM architecture after 1981, after which it kept expanding its user base with new applications. The Internet's development pushed PC use to new users between 1994 and 2000. By 2000, virtually every type of US business and home user likely to try a PC had done so. After 2000, virtually all demand came from experienced PC users.

The combination of technical and market maturity provides a straightforward explanation for the small margins in PC hardware. Except for price, suppliers have little basis upon which to differentiate their products. In a related way, it also explains why it is possible for a supplier—Dell Computer in this case—to have a high market share through focusing on low-cost distribution and investing in process engineering. It also explains why IBM did not (and could not) make much money off its PC division, whether in the 1990s or today.

HP's and Compaq's management were deeply aware of this market and technical maturation. It underlay the belief that providing services was more profitable than selling hardware. That is not the same as justifying the merger, but it says that the premise contained a grain of truth.

As another example, Oracle also serves a mature user base, those who use large databases. Again, oversimplifying to illustrate the point, the Internet's diffusion altered database use after 1994, but that process began to peter out after 2000. There simply were not many potential new users left except in small business, where SQL had a large lead and Oracle was unlikely to make progress. Moreover, most of the biggest growth areas in large-database applications emerged in enterprise

resource planning, where SAP has an entrenched lead.

Oracle faced a solid—albeit, unexciting—future. Though it could continue making money, Oracle knew its direction of change was quite predictable. That is not the same as excusing what Ellison did next but, once again, it verifies the premise. The assertion about market maturity contained a large grain of truth.

The executives at Motorola, in contrast, have faced a more confusing market situation. The IC market contains a mix of mature and adolescent markets, and this situation has been changing over the last two decades. For example, the analog, low-end microchip and low-end DRAM memory markets appear to be mature, but many custom devices contain unpredictability in their supply chains. In these areas, you still see supplier and buyer turnover, symptoms of lack of market maturity.

What is organizational maturity?

Most executives aspire to run a mature organization. Mature organizations embody a set of routines and processes that reflect management principles for describing how the company will deliver value. The primary benefit of organizational maturity is strategic consistency.

Consistency leads to strategic predictability at a broad level, while preserving tactical flexibility. For example, Andy Grove became famous for imposing a consistent strategic philosophy at Intel, the "paranoid strategies." These principles translated into a predictable attitude toward new challenges: Take aggressive proactive action to prevent worst-case scenarios. That imprint was widely communicated to managers—so much so that students of that firm could practically anticipate Intel's actions in every managerial crisis.

Imposing strategic consistency is similar to, but not exactly the same as, refocusing the business at an established firm. Refocusing involves altering the lines of business in light of the mismatch between prior competitive strengths and the anticipated maturity of technologies and markets. To be clear, imposing consistency *causes* refocusing (among several poten-

tial changes), not the other way around.

For example, IBM's actions in the PC market had more to do with the organization's refocusing *in response* to a strategy it adopted much earlier. Under former CEO Louis Gerstner's leadership, IBM experimented in the 1990s with services for large buyers, a market segment in which IBM had long standing business relationships. After a decade of experimenting with this strategy, IBM has become more of an IT services firm. Making PCs did not contribute much to that strategic goal, and, arguably, took away from it because customers and other hardware firms sensed mixed motives. In addition, for reasons already noted, there was little money to be made selling PCs. Though there was no necessity for the divestment, IBM's executives finally made a strategic choice about where it focused managerial attention.

Organizational refocusing explains Motorola's actions, too. The IC division had a respectable record of innovation over several decades, but that record was not essential to Motorola's recent success or failure in communications networking and handset markets. In short, the division sold ICs to both internal and external customers in a mixture of adolescent and mature markets, and, because of market maturation, Motorola could potentially consider buying ICs from other suppliers for most of its key products. Once again, divestment was not a necessity. Divestment was a strategic choice about potentially using multiple sources of ICs at Motorola, and about focusing the attention of Motorola's management *and* Freescale's management on issues other than their relationship with one another.

Human side of restructuring

Why is restructuring so controversial when maturation is not?

First, when pressed, some executives could not explain how maturity *necessitated* mergers or divestments. Although the premise could be correct, there was a big difference between choosing a calculated gamble and devising a strategy necessitated by the need to survive. The trade press smelled imprecision and

exposed it with quotes from contrarians.

Second, if employees understand that restructuring is a choice, another deeper controversy surfaces. Somebody almost always gains from restructuring while *someone else* loses.

For example, PeopleSoft's employees and managers lost control over their firm's direction, and many also lost their jobs. These losses came after an unwelcome hostile takeover that benefited Oracle, a firm many PeopleSoft employees already disliked.

As another example, HP's organization retained a strong atmospheric imprint from its founders, one that served the firm well in a prior era. Many long-time employees (as well as the HP heirs) believed the merger with Compaq would eliminate the imprint, a unique organizational atmosphere they valued. Their potential loss was emotional, but no less real.

These losses contain an additional bitter and ironic twist of fate for many employees who had chosen *not* to work at entrepreneurial firms during the dot-com boom, passing up big money in risky situations. They chose stable firms with well-deserved reputations for taking care of their employees through thick and thin, such as IBM and HP. Such employees felt vindicated by the dot-com bust. Yet, before they could enjoy this stability for very long, an executive decided to alter their work environment, which is just what they had tried to avoid all along.

More generally, risk falls unequally on different parties because the gains from restructuring are far into the future. What pleasure does an employee receive from paying the cost today and bearing the risk of a calculated gamble, if someone else realizes most of the gains later?

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Corrections

In the November-December 2004 issue of *IEEE Micro*, Figure 3b in the article by Srinivasan et al. ("Continual Flow Pipelines: Achieving Resource-Efficient Latency Tolerance") was incorrectly displayed. Below is the corrected version of the figure and caption.

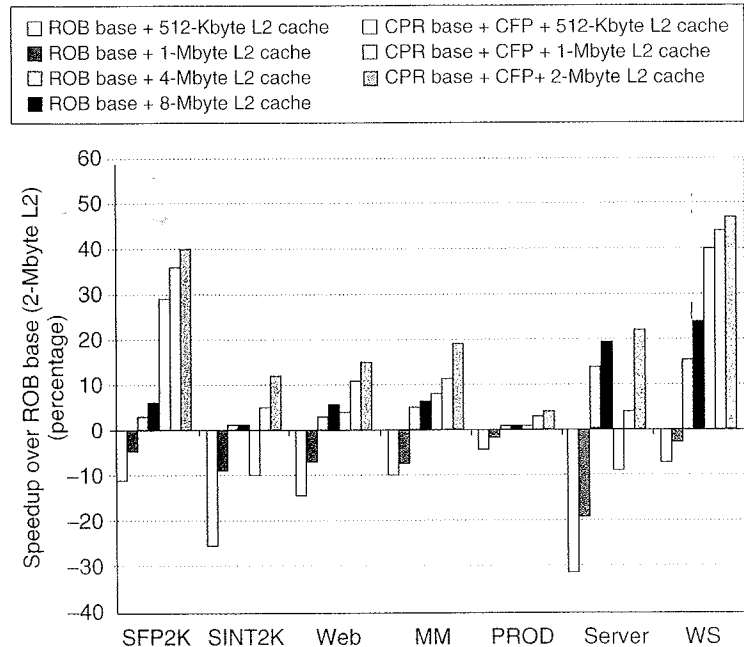


Figure 3b. CFP performance over various benchmark suites. Results show performance gains across various CPR base + CFP and ROB base configurations with varying L2 cache sizes. Each benchmark suite has seven bars grouped together. The first four bars of the group correspond to ROB base configurations and the remaining three bars of the group correspond to the CPR base + CFP configurations for different L2 cache sizes as shown.

The following corrections are for the article by Pin Zhou et al. ("iWatcher: Simple, General Architectural Support for Software Debugging") in the November-December 2004 issue of *IEEE Micro*:

In the first sentence of the third paragraph on page 50, the sentence should have read: The state of the art in microarchitectural support for software debugging is limited largely to watchpoints, as in the IA-32 architecture, and to event or branch trace buffers, as in the IA-32 architecture and Pentium 4.¹²

In the second sentence of the fourth paragraph on page 51, the sentence should have read: iWatcher lets programmers or automated debugging tools associate monitoring functions to memory locations or objects.

In the footnote for Table 2, P. Zhou's name was misspelled.

IEEE Micro regrets these errors.