

Analysis - Disruptive Innovation

By Keith Mallinson Sunday, August 31, 2008

PC industry be warned. Mobile devices are taking computing to everyone, everywhere and all of the time.

PC market leaders are being threatened by a new computing paradigm, as were their predecessors in minicomputers and their predecessors' parents in mainframes. Mobile devices are set to dominate personal computing.

Disruptive technologies can rapidly push aside market leaders or marginalize their positions. Clayton Christensen's 1997 book *The Innovator's Dilemma* illustrates how Intel's 8088 microprocessor, the hydraulic excavator and a succession of computer hard drive technologies revolutionized markets with major changes in market positions for suppliers.

Disruptive technologies tend to be cheaper, more flexible with wider applicability and outsell what they displace. They succeed despite initially providing lower performance than incumbent technologies.

Mobile phones have transformed telephony with about 3 billion users worldwide. That's more than twice the number of fixed lines.

In computing, successive generations of lower-end technologies have had the greatest commercial success. The mainframe market was disrupted by minicomputers. Microprocessors created an entirely new market for personal computing while exerting catastrophic competitive pressure on several mainframe and minicomputer vendors. Microsoft and Intel succeeded at the expense of IBM, Digital Equipment Corporation and others.

The PC market is now under similar pressure from ARM-based mobile computing platforms. These go by a variety of names including mobile Internet device (MID), ultra-mobile PC (UMPC), multimedia computer, iPhone and smartphone. ARM-based processor cores are incorporated in baseband and application processor chipsets from vendors such as Qualcomm and Texas Instruments to provide modem control, messaging, browsing, audio and video. These cores are much more frugal on power consumption and cheaper than the devices used in PCs and laptops.

Christensen's book also describes unsuccessful attempts by incumbents to compete in the face of disruptive technologies by going up-market with what he calls sustaining innovations that provide increased performance. Supercomputing is an example of this. It provided performance improvements over mainframes and scientific workstations. It was, however, only a niche market.

Intel is currently innovating on a sustaining basis with its Larrabee microprocessors to include up to 48 cores for the graphics processing required in high-end computer games. How large might the market be for these versus entry-level computing devices for the billions on low incomes worldwide?

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The PC is not best-suited to the needs of most people most of the time. In developed or developing nations, people with highly mobile lifestyles such as farmers, fishermen and truck drivers will be better off with an alternative. Nicholas Negraponte's one laptop per child at \$100 apiece has met with lackluster demand. This is partially due to cost: Entry-level phones cost about \$25 unsubsidized in developing nations, largely due to



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distribution, branding and the need to make devices, applications and services relevant to entry level and low literacy users while serving new usage models. An alternative to conventional QWERTY PC-based machines, which among other drawbacks crash so often, is refreshing for experienced PC users and less intimidating to novices.

Computers have relatively low penetration, are slow-moving and pricey in comparison to cellular devices. According to Gartner Group, there are more than 1 billion PCs worldwide. This is a large number, but there are three times more mobiles. The firm forecasts more than 180 million unit sales in 2008. That's less than one-seventh Nokia's market estimate of 1.25 billion mobile devices. With the average selling price of mobile devices running about \$120 globally, PCs are roughly five times more expensive. NPD estimates \$550 and \$700 retail for desktops and laptops respectively.

Computing-enabled devices will outnumber PCs by orders of magnitude. Within a decade, there will likely be 1 trillion cores worldwide in handhelds and embedded in cars, consumer electronics and domestic appliances.

Innovation in mobile devices is driven both top down and bottom up. Most mobile devices are still medium or low-end devices with only modest computing capabilities. However, innovation from high-end devices such as Qualcomm's Snapdragon chipset and Nokia's flagship N95 phone will rapidly percolate downward.

Meanwhile, the process advancements, silicon integration and cost reductions achieved in the large volume market for low-end devices also benefit the middle and high-end devices.

Mobiles will become the primary and most pervasively used or only computing devices for most of the world's population. Much of that population hasn't had a phone for long. More have not yet used or rarely used a computer or Internet connection. Rich computing functionality including large color displays will increasingly be found at modest cost in mid-range mobile devices. All we need now is appealing applications, services and pricing to drive demand.

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