The Hot, New Netbook Market: What Makes it So Compelling?

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Table of Contents

Introduction

The netbook is quickly becoming the next "must have" device among a wide range of enthusiastic users. These small, affordable mobile computers are members of an emerging category that fits between two high-profile categories, the smartphone and the notebook. Almost as convenient to carry as a mobile phone, the netbook has the familiar ease of use of a laptop when surfing the web.

Figure 1: Mobile Computing Devices

Three important benefits explain why this new market is so compelling:

- Convenient web connectivity
- Easy mobility
- Low cost

The name "netbook" captures the first two of these benefits, although the important aspect of mobility is better conveyed by the names "ultra mobile PC" (UMPC) and "mobile Internet device" (MID). Other names such as "mini laptop", "mini notebook" and "sub notebook" are also being used to emphasize the compact size. The third benefit, low cost, is best conveyed by yet another name, "ultra low cost PC" (ULCPC). About 20 different models of netbooks are expected to be offered during the second half of 2008, and with this, a proliferation of names and competition.

This backgrounder explains the driving forces that brought the netbook market to life, and identifies the parameters and device architecture that best meet its objective.

The Emergence of the Netbook Category

The netbook market is one of the newest and most exciting markets to emerge in recent years. The growth potential of the netbook market is conservatively estimated by PC manufacturers and the analyst community at 13 million units by the end of 2008. AsusTek Computer Inc. (Asus), the founder of this market, publicly disclosed market projections of up to 35 million units by 2010.

Like any fast-growing market, timing is everything. The technological convergence of lower cost, more power efficient components and a true need for “on the go” connectivity triggered the emergence of the netbook market. Several other contributing factors converged to make this market ripe now: the abundance of web connectivity, the prevalence of hot spots, and increased bandwidth. In addition, lower cost hardware components such as storage, LCDs, processors and the supporting software are important contributors to the emergence of this category.

What characterizes a netbook?

The primary purpose of the netbook is to enable easy web access. For the first time, this functionality is combined with low cost, all in a lightweight and extremely portable casing. The smartphone, whose price range is similar, does not allow for a PC-like experience due to its small screen and cramped keyboard, taking the fun out of content viewing and making data entry difficult.

Netbooks are designed with familiar keyboards. Even though they are smaller than traditional laptops, they are convenient enough for typing with both hands.

Today’s Typical Netbook Specifications

Retail price	$250-$600
Weight	~1kg
LCD panel	7”-9”
Storage type & capacity(*)	Flash-based solid state drive (SSD)
	4GB-16GB
Microprocessor	Intel Celeron-M, Atom, VIA C7-M
Operating system	Linux, Microsoft XP
Memory card slot	1-2
Wireless Connection (**)	802.11b/g
(*) HDD options are available for higher capacity (**) Some manufacturers are partnering with service providers for 3G web access	

How is the netbook positioned vs. other mobile devices?

The illustration in Figure 2 shows the positioning of the netbook market relative to the established traditional notebook and smartphone markets. The UMPC is shown here as the more expensive predecessor of the netbook market. Ballpark figures are shown for each of the market segments for typical weight and LCD size. The Y-axis shows the device affordability factor determined by cost. The X-axis shows the usability factor, measured by ease of web surfing and portability.

When looking at the affordability factor, the netbook has a low cost advantage over the traditional netbook and UMPC.

When looking at the usability factor, it is apparent that the netbook is targeted much more effectively than the smartphone to meet the need for easy web browsing and data entry. The netbook also has a higher usability factor over the traditional laptop in terms of portability.

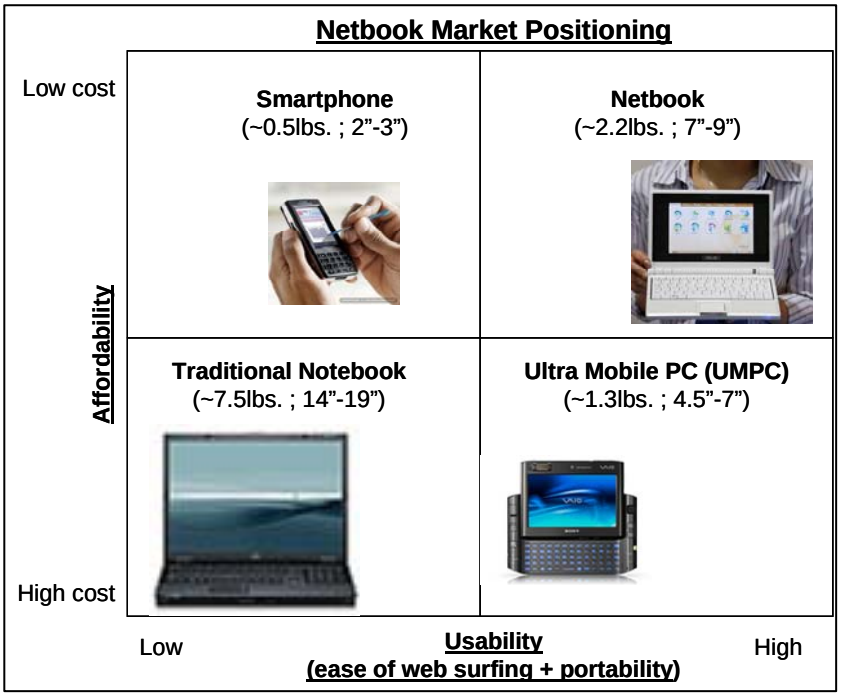


Figure 2: Netbook Market Positioning

What makes the netbook so compelling?

The emergence of the netbook market answers mainstream user needs for a lightweight, mobile, affordable computer that can be connected to the Internet everywhere users go, with the familiar and convenient user interface of a laptop. The amazing growth in web usage for communication and socializing is further driving this market, making it a compelling solution not only for youth but also for a wide spectrum of users who choose to be connected everywhere.

The relentless free connectivity enabled by wireless access characterizes much of today’s online behavior, marked by an explosion of applications catering to this need. Growth in social networking, primarily popular with the younger generation, is replacing email and chats with personal sites for information sharing, such as MySpace, Facebook, and others. This new connectivity has become a staple of our everyday lives. In addition, more and more jobs rely on email connectivity around the clock, facilitated by wireless access. Work-driven access often fosters greater personal email frequency, as well as other kinds of online entertainment activities.

Mobile access to the web is pushing Internet adoption rates up and is expected to continue to do so. The availability of online software now enables document and presentation creation, spreadsheet preparation, photo manipulation, calendar handling as well as typical web browsing and email without much computing power or high storage capacities. Breakthrough devices such as the netbook make it easier to take full computers, and not just cell phones, anywhere and everywhere.

Where can netbooks add value?

As the netbook market gains momentum, netbooks are beginning to benefit a range of users coming from very different lifestyles. Consider the following usage scenarios:

- Family-mate: In middle-class families with teens and pre-teens, a netbook functions as a satellite device to be used for social networking and emails. Instead of fighting for computer time on the family's desktop, children take their netbooks to their favorite lounging spots to stay connected with their friends.
- Vacation-mate: Users take their netbooks on vacation to stay in touch with family and friends back home, while at the same time gain easy access to on-site restaurants, entertainment spots, nightlife, etc.
- Business travel-mate: Business travelers use their netbooks in tight quarters, such as on planes or in cramped business lounges, to maximize their productivity. While at industry events, business people take their netbooks to stay in touch with coworkers.

All of these users can benefit from the netbook's reduced size, weight and extended battery life. Not having to carry around a heavy power supply is an added side-benefit.

A Short History and Future Growth Directions

Until recently, the computing trend focused on building laptops with more power and higher performance; the stronger and faster, the better. This direction totally neglected the real, growing need for small-sized, lightweight computers for mobile web connectivity at a low cost. Even when portability was addressed in 2005 with the release of the ultra mobile PC (UMPC), its price was often more expensive than a traditional laptop, which became a barrier to market penetration. For example, earlier ultra-portables such as the OQO Model 02 and Sony Vaio UMPC cost in the range of $1500 to $2,000.

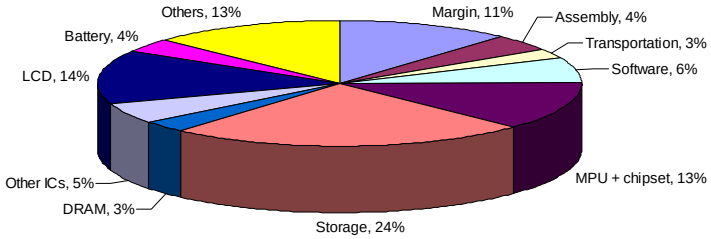
In parallel, another trend developed in 2005, which brought the low cost PC (LCPC) market into existence: the non-profit venture one laptop per child (OLPC). It addressed the cost issue head on. Founded by Dr. Nicolas Negroponte, an MIT professor, the initiative of a "$100 laptop" is targeted at furthering education in the third world and bridging the gap to the western world. This project is still underway; however, it gave rise to a much larger market in the developed world. LCPCs are now being targeted not only at underdeveloped countries but also as an attractive offering for a wide range of users in developed nations.

The dawn of the netbook market is largely attributed to Asus, with the introduction of the Eee PC in October 2007. Asus' small, low-cost Eee PC is a phenomenal success, with reported sales of more than a million units. This success has prompted other manufacturers to announce their own offerings, including such mainstream PC manufacturers as HP, Dell and Acer.

Wealthier countries are excited by these devices as second laptops, gift items for kids, entry-level laptops for students, and light travel-mates for business users. Another market is expected to emerge in developing countries such as China, India and in eastern Europe, where the traditional laptop cost is beyond the means of the majority of the population. In these regions, the netbook is predicted to become popular among a range of users who formerly could never consider mobile computing.

Looking Inside the Netbook

In a recent report[1], DAIWA Research offers a model of the cost breakdown of the various components inside the netbook. Their relative proportion of the bill of materials (BOM) is represented in the pie chart (Figure 3). Especially for this cost-sensitive market, it is important to examine the components that have the most impact on the device cost.



FFigure 3: Relative Costs, Netbook Components

Storage

According to DAIWA's model, hard disk drive (HDD) based storage accounts for 24% of manufacturing costs, by far the most expensive single component in the system. It is interesting to note that this percentage is significantly higher than in the traditional laptop, where it is closer to 10% of the BOM.

In the netbook market, the value proposition of solid state drive (SSD) storage is convincing. Both PC manufacturers and the analyst community widely endorse it. Jeff Janukowicz of IDC[2] wrote: "From a storage perspective, ULCPCs and SSDs appear to be a good match. SSDs provide the required small form factor, durability, and low power consumption needed for these devices. Perhaps most importantly, SSDs can provide the required capacity at very low price points."

[1] DAIWA Research, "Netbooks Hit the Market: Their Impact?" June 2008

[2] IDC, "Ultra Low Cost PCs and SSDs. A Good Match", Doc # 212765, Jeff Janukowicz, June 2008

J. Unsworth, Research Director at Gartner, expects the low-cost SSD category to grow from 635,000 units in 2007 to over 33 million units in 2012 (Figure 4), representing a five-year compound growth rate of 117%.

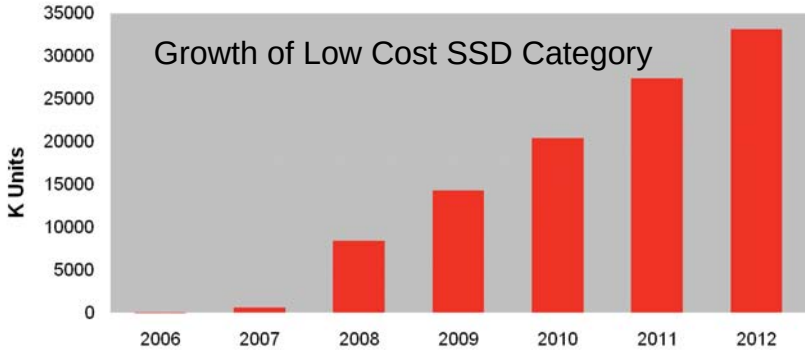


Figure 4: Predicted Growth, Low-Cost SSD

The *raison d'etre* of the netbook segment, as noted in the introduction of this paper, is to allow end-users to enjoy low cost, convenient web connectivity, and easy mobility.

All of these three benefits are best served by a flash drive over the traditional mechanical HDD. Since the primary purpose and usage scenario of netbooks is online connectivity, the need for storage capacity is minimal. The higher capacities of traditional HDDs is an overkill that comes with a price penalty. Particularly since the storage device is the most significant component of the BOM, netbook manufacturers are actively seeking to reduce associated costs, and are unwilling to pay for more capacity than users need. At capacities under 16GB, SSDs are already becoming the preferred storage device.

As the market trend for declining flash prices continues, side by side with technological advancements, SSD capacities even higher than 16GB are expected to cost less than HDDs. In addition, PC manufacturers have built in memory card slots to enable after-market memory expansion. In this way, additional flash storage may be used if and when needed. This strategy allows manufacturers to keep initial netbook costs down.

Beyond SSD cost advantages at low capacities, flash-based SSDs have additional advantages over mechanical drives. Their better durability, lower weight, smaller size, longer battery life, lower heat emission and quieter operation make SSDs an ideal choice for netbooks that are built first and foremost for mobility and portability.

Extended battery life, due to the fact that SSDs use less energy than spinning-disk hard drives, is particularly relevant. It paves the way to all-day computing, bringing netbook users a double-edged benefit: they can keep working all day without recharging the battery; they do not have to lug the heavy and cumbersome power supply.

The photograph in Figure 5 shows the printed circuit board (PCB) of a netbook that was designed to use a 2.5" HDD (the gray rectangular hole on the left). This last June, SanDisk introduced its SSD PATA module, named pSSD, designed especially for this market. The pSSD would require only about a fifth of this space!

2.5" HDD SanDisk pSSD

Figure 5: HDD vs SanDisk pSSD Footprint on Netbook PCB

Jeff Janukowicz of IDC[3] compared all important aspects of SanDisk's pSSD to Intel's offering, shown in the table below:

ULCPC SSD PRODUCTS

Metric	SanDisk pSSD	Intel Z-P230
Form factor	Module	Module
Size (mm)	54 x 32 x 3.0	54 x 38 x 3.2
Technology	SLC and MLC NAND	MLC NAND
Capacity (GB)	4, 8, and 16	4, 8, and 16
Read	39MBps (sustained)	35MBps (sustained)
Write	17MBps (sustained)	7MBps (sustained)
Power	Standby current: 800µA (max.) Active current: 150mA (max.)	Idle: 1.65mW Operating: 314mW
Weight (grams)	5	Typically 10
Temperature Range	0°C to +70° C	0°C to +70°C
Interface	PATA	PATA
Mean time between failure (MTBF)	4 million hours	1 million hours

Note that SanDisk's pSSD performance and MTBF are significantly higher than Intel's Z-P230, and that recent power measurements show similar results for the two devices.

LCD Panel

Another important component determining the cost of the netbook is the choice of LCD. The major challenge that manufacturers are facing is driven by user convenience, and can be summed up by this question: How small is big enough? Other challenges include keeping the LCD lightweight and the cost low.

In their initial release, Asus offered 7" screens that were considered the smallest possible for easy web surfing. The current trend is toward a slightly larger screen,

[3] IDC, "Ultra Low Cost PCs and SSDs. A Good Match", Doc # 212765, Jeff Janukowicz, June 2008

8.9”, as recently announced by Asus itself as well as Acer, HP and Dell. This size appears to be a good compromise between clear display and size/weight considerations.

Lowering power consumption to extend the battery life is another important consideration. To support this need, we are now seeing the adoption of LED (light-emitting diode) backlights whose cost is competitive with the CCFL (cold cathode fluorescent light) backlights for LCDs in the 7” to 9” range.

Microprocessor

Netbook low cost requirements impact on the choice of microprocessor. PC chipmakers are seeking strategies to provide a small, low cost and energy efficient MPU while keeping performance at an acceptable level to meet netbook usage scenarios. The logical tradeoff is limited processing capabilities in return for optimized Internet-based usage.

Intel introduced the now popular Atom MPU, which joins the already popular Celeron-M processor, to better meet netbook requirements for low cost and low power consumption and to extend the battery life. Atom is about a quarter in size of other low-end chips. Intel’s next-generation process technology enables these offerings to provide sufficient performance. Asus has publicly spoken of incorporating both Celeron-M and Atom in their netbooks. Other chipmakers, such as VIA Technologies, have introduced their C7-M MPU for this market, which is used inside HP’s Mini-Note.

Operating System

Low cost is again one of the prime considerations in evaluating operating system (OS) support for netbooks. When one thinks low cost, open source software immediately comes to mind. The natural candidate for the netbook market is Linux. Indeed, nearly all of the approximately half a million netbooks sold in 2007 were loaded with Linux OS. In addition to the cost advantage, Linux requires a small footprint and lower graphic requirements.

But Microsoft is also staking its claim in this hot, emerging market. Its dominance in the traditional computing market has been grounded in its strategy of building more sophisticated, feature-rich OSs. The tradeoffs of such a strategy, as with Windows Vista, is more powerful, more expensive hardware, in addition to using a significant amount of system resources. These tradeoffs are clearly not acceptable for netbooks, which do not have enough memory to run even the most basic version of Windows Vista. Microsoft, therefore, recently announced the extended availability of a basic version of Windows XP, Windows XP Home, offered for netbooks with an LCD of up to 9”. To sweeten the offering, Microsoft also slashed the cost of a license for XP running on netbooks. Netbook manufacturers have begun to put Windows XP Home on well-defined platforms such as the Asus Eee PC.

Both offerings have their advantages. Linux requires a smaller footprint than Windows XP Home, whereas Windows XP Home offers broader compatibility and familiarity.

Conclusion

The web is a vibrant part of our daily lives. We are all eager to share information, photos, music, personal content, and to stay connected to the Internet everywhere we go: cafes, restaurants, bookstores, transit stations, parks and of course office service locations.

Instantaneously accessible information is one of the paramount benefits of the web to get answers to questions such as “What’s on tonight?” or “What’s the weather forecast where I’m flying tomorrow?” or “Where can I find a good French restaurant and how do I get there?”. For sharing a thought with a friend, simply chatting, or extending greetings on special occasions, using the web has become second nature to a growing percentage of the population.

The netbook is emerging as the perfect match to mobilize all of these web benefits. It will likely exist side by side with the smartphone and the traditional notebook, which serve different sets of user needs for mobile lifestyles. Because connectivity for people “on the go” is the netbook’s prime goal, it requires neither high-capacity storage nor a high-power processor. This is enabling netbook manufacturers to drastically reduce costs. Designing in components that actually meet rather than exceed user needs, such as cost-effective flash-based SSDs in low capacities, has enabled manufacturers to offer these compact mobile computers at a cost that is appealing to a large and diverse user base.

The excitement generated by the new netbook market is clearly justifiable, and expected to grow as additional manufacturers join the market and roll out new offerings.

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