PLANNING ASSUMPTION

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Modular Computing: The Next Generation of Personal Computing

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Giga Position

Performance is no longer driving the market, users increasingly need their technology to be where they are and the market is stagnating because potential customers no longer see the need for staying current with their technology. Handheld computers are promising but generally too limited to be stand-alone devices. Smart phones are connected, but even more limiting for computing tasks than handheld computers. Devices that try to do both generally result in a screen that is too small and a phone that is too big. There is a growing perception that combining the two in a modular approach can provide a phone of the right size and a connected handheld computer without the negatives of a combined device.

This same modular approach foretells the next iteration of the personal computer — a device assembled from modules that can change personalities from small and portable to desktop, to full-size laptop without incurring the lasting negatives of any design. It will be a configuration that can be updated in components, where the buyer only has to upgrade the part that is out of date without wasting money and harming the environment by disposing of parts that are still serviceable. And it will be a concept that provides for a single image covering all employees that can be inexpensively and quickly updated simply by replacing the core module. It will be a solution that can move from the living room, to the automobile, to the airplane and to the office by morphing into the productivity device, entertainment device and communication tool — whichever is ideal for each environment. It will be a truly personal computer that represents the future we see as modular computing.

Proof/Notes

There are three critical problems the current PC market is trying to address. The first, and most important to vendors, is the lack of demand and resulting collapse of the revenue engine that drove the market through 2000. The second, and most important to large corporate buyers, is the cost associated with deploying and managing large numbers of desktops. And the third, and most important to the user, is the complexity and rigidity of the related products that have them preferring old equipment over new and making hard choices between less than ideal product types. In the last, the complaint is that PCs are not particularly "personal." We will address each of these areas and use this analysis of the problem to build a case for an emerging class of personal computer we call "modular" PCs.

Background

When the PC first entered the broad business market it carried with it much of its "hobbyist" roots. It was configurable (customizable), relatively large and not portable. Similar in many ways to the terminals that it replaced, the user needed to come to the early PC, learn its language and spend a great deal of time on care and maintenance of the device. Computers that were purchased in the early 1980s were, for the most part, still in service in the early 1990s and the drama at that time was whether a GUI was needed over the then standard command-line interface. The big battle was between **IBM** and **Microsoft** over the operating system, and **Compaq**, largely as a result of aligning with the winner of the OS battle, emerged as the leading PC vendor. Performance was the leading problem and portable computers were, for most of this period, 20 to 30 pound machines with tiny screens and relatively low reliability.

Even at the end of the period, many personal computers were departmental devices not owned or controlled by IT but maintained by and for the benefit of the individual user. They were personal computers in a very real sense because they were purchased specifically for the user who tended to be the leading expert on that purchase and intimately involved with it. **Apple**, which appealed to the user directly, enjoyed the largest market share of any PC manufacturer as a result.

In the early 1990s we went through what was, in hindsight, the first major change in personal computing. The industry moved away from command-line interfaces, the equipment moved into the general workforce and the "personal" was driven out of the computer as it became a corporate device. Now the needs of the corporation drove the purchase, and concepts of personal productivity drove purchase decisions. Much like the difference between a corporate and personal automobile purchase, PCs became generic, leasing became common and a replacement cycle, not unlike what existed for automobiles, was implemented. As it was with automobiles, in recent years PC buyers stopped learning about how their machines worked and the care and maintenance of those machines passed to others.

The machines themselves got more complex because they were asked to fill an increasingly generic role. Where they might have largely been for financial calculations (accounting), word processing (operations, legal) or database work (finance, sales, etc.) in the 1980s and customized for that use, they became the Swiss army knife of office tools in the 1990s as they were asked to be all things to all people and the defining product was **Microsoft** Office rather than **Lotus** 1-2-3, DisplayWrite or Multi-Mate. Windows 95 defined the last decade, a corporate standard that drove out Apple, and OS/2-based products locked in place a three-year hardware replacement cycle (previously it had been five to eight years for desktop machines) and fueled what became one of the most lucrative and powerful markets in the 1990s.

The Year 2000 preparation, **Netscape** and the related emergence of the Internet put a stake through the heart of the PC market and began the shift away from the desktop and back to a model that was more similar to the mainframe market, in that it attempted to retain much of the personal nature of the solution. Performance became less about the processor and more about network bandwidth, and the market started moving away from a product model to an Internet services model. However, the initial growth of the new model was over-subscribed by investors and employees in an apparent repeat of the California gold rush, assuring this move to services would be non-linear and extraordinarily painful.

Intel and Microsoft, seeing that the move to Internet services would collapse the existing model, jointly developed a technology code named "Chrome," which would have used the PC's processor to overcome what was likely to be a continued bandwidth problem and allow the then-existing revenue model to hold during the transition and, likely, for some time thereafter. Unfortunately, Intel's testimony during the US government antitrust trial against Microsoft resulted in the collapse of that program and Microsoft itself moved to .NET, which is currently fueling the belief that PC performance is not important. Intel appeared to agree by moving into networking and consumer products, and the 2001 PC market collapse was partially the result of these decisions.

We now enter the new millennium with the move to Internet services substantially slowed and gated by both the lack of adequate bandwidth and the immaturity of .NET, coupled with heavy antitrust litigation against Microsoft, the vendor that controls most of the existing PC standards. Estimates of market recovery continue to be moved out, and should that recovery occur in the PC segment, there is a growing belief it may shift out to late 2003 or 2004.

The market is not only primed for another change that addresses its current needs, but the market recovery in the PC segment is predicated on finding that change so that a sustainable revenue engine can be rebuilt and market growth can return the key players to health and prosperity. The solution needs to have aspects that deal with the critical needs of the key market players: users, IT buyers and vendors.

Defining the Solution

The user, who formed the foundation of the initial PC market, continues to be the most likely driver for the market recovery. Currently users are not seeing a need for new technology; in fact, more often than not they are not only not asking for new hardware, they are asking that IT leave what they have alone and not try to fix what is not broken. With the current driver for change, Microsoft's and Intel's own technology cycles, unlike the automobile market, are not effectively fueled by marketing (demand generation). The market stagnation is likely to be extended if vendors cannot find a technology that can be cycled quickly and where that cycle is fueled by user/buyer demand. Users are buying and refreshing relatively low-cost items like cell phones, digital cameras and MP3 players on a regular basis. These items have a low personal switching cost, are seen as personal in nature and have price points for core components that are under $500. In some cases (digital cameras) they can be enhanced with accessories that significantly increase both the cost and the related value of the purchase. In addition, during the market downturn, **Logitech**, a PC accessory company, did very well largely be selling relatively low-cost items that enhanced the PC experience like speakers, keyboards, mice and desktop video cameras.

This would suggest that the user would more aggressively accept a component approach to the PC, where the overall solution could be customized to the user and each individual component would, at some point, come in at a price point (deployment cost and system cost) where the IT organization or the user would accept a two- or three-year replacement cycle for that core component. Clearly the ease of migration from one configuration to another would need to be addressed, as would migrating to a new technology level. In short, the migration experience would need to be as simple as plugging in a cassette tape or getting a new car (without the sales cycle).

The IT organization is simply overwhelmed with the massive complexity of large numbers of nearly unique (hardware and/or software) desktop and mobile configurations and the constant worries of employee miss action, equipment failure and platform surprises (e.g., Microsoft pricing programs). Many would clearly like a world where much better PCs didn't exist and a return to a world where the user had more direct responsibility for the day-to-day care of their PC. For them, a solution where you passed out a preconfigured device that could be easily replaced if broken and where personal activities could be clearly separated from company activities would be like finding the pot of gold at the end of the rainbow.

Here, too, a component approach where the OS and software applications were tied to the hardware and replaced as a unit would seem to be ideal. This could avoid the problems with image management and result in an environment that could be more easily managed because it would consistently be current and much of the complexity would exist outside of software. The solution would need to be secure, however, so that a module containing intellectual property could be appropriately protected. The concept where an employee would be able to move physically from a protected corporate image to a personal image has an attraction for this group, particularly for employees who work from home. (There are an unacceptable number of stories where employees, or their children, have done substantial damage to a company by using PC equipment inappropriately.)

Finally, the vendors (particularly the chip vendors) would like to see a configuration that had a relatively high cycle rate. This would allow them to have a more even revenue stream and maintain a more consistent relationship with the customer. They would also like to be able to differentiate, because the current branded white-box market is so cost focused it only benefits one very efficient vendor, and the market collapse is clearly impacting the growth potential of all vendors — including the market leader. In addition, service cost, particularly when the product is under warranty, is a nearly uncontrolled expense. Having a platform that could be easily and quickly swapped out and shipped back for disposition rather than repaired on site would generally be preferable from an expense standpoint, as well as provide an opportunity for even lower system prices, increasing the likelihood of higher sales volumes going forward.

In short, the PC vendors want a product that can compete effectively in the personal electronics segment

without giving up the kind of value add they supply to the corporate segment. They would benefit from an approach that could provide for strong differentiation in a Microsoft/Intel world and avoids making the PC market into one dominated by one, large low-cost provider.

The Modular Computer

There is only one product category that appears to have a chance, when coupled with the appropriate back-end services, of supplying the majority of the needs we identified above. It is the modular computer concept put forth by **Xybernaut** and marketed as the transferable core, recently demonstrated by IBM as the MetaPad and just announced at Microsoft's WinHec conference by a Silicon Valley startup **OQO**. This product, which likely would not be possible without the Transmeta chip and **Toshiba** hard drive, will be the first targeted at the general market.

OQO's product will make it to market first. It was developed by a group who helped design the Apple Titanium notebook computer and the core module has the following specifications:

- 4.9-inch x 2.9-inch x 0.9-inch form (slightly smaller than a Compaq iPAQ handheld computer with the CF sleeve)
- 1GHz Crusoe TM5800 Processor
- 256MB SDRAM Memory
- 10GB Toshiba Hard Drive
- 4-inch high resolution, ultra bright touch screen
- Lithium polymer battery (two hours movie viewing or up to eight hours general productivity per charge)
- 1394 port (Firewire)
- Three USB 1.1 ports
- Bluetooth
- 802.11 wireless

Accessories would include a laptop carrier and desktop dock. The laptop carrier would have a second battery, optical drive option, a larger LCD screen, pointing device and keyboard.

Target price for the core module is expected to be around $1,000 in initial, low-volume quantities and should drop as the product ramps to its market potential the following year. It is due to market in the second half of 2002.

IBM's prototype is larger and lacks the ports that the OQO device has in abundance. It is also not yet slated for release. Other than that, both products are similar in concept and design. It is interesting to note that IBM has been working on this project for several years.

By putting the core PC technology — processor, drive, memory, video — into the smallest form possible, you can create a platform that can be applied to a number of needs. Much like inserting a cassette, you can simply plug your core module into a desktop carrier, laptop carrier or handheld sleeve to get full PC capability in the size device you need for a specific task — and it need not stop there. You could insert it into an automobile for a telematics solution, into a stereo carrier to play your MP3s or receive a music stream, or use it to show slides, or as the core of a gaming system.

Strangely enough, this class of product will benefit greatly from the miniaturization that has occurred around

handheld computers. Currently there are a wide number of low-powered cards from **Socket** that can provide wired and wireless connectivity, keyboards from **Logitech** and **Pocketop** (wireless). Processing power in this form has reached a point where even voice recognition products like **Dragon Dictate** are a viable. In fact, thanks to the miniaturization involved in developing handheld computers, cell phones and cameras, the potential option portfolio for a modular computer is very strong and, were it not for this development, the near-term future for this device would not be anywhere near as promising.

As it was with the emergence of the PC, fortunes may be made and lost as this new platform matures. Transmeta and IBM, not Intel, are the major hardware sponsor, while the major software sponsor, once again, appears to be Microsoft. A critical gating factor to the platform will be cross-vendor standards, which were missed badly by Microsoft's PocketPC and the palm products from **Palm**, **Sony** and **Handspring**. In addition, the first version of anything this new is more of an extended beta where vendors, and users, discover what features and functions they really want.

In the end, this category will live or die based on how well the players have learned the lessons of the past, how effectively they can apply those lessons and if they can market the benefits of this new class to users who have been heavily jaded by a long string of over-hyped products and missed promises.

Alternative View

Whenever a replacement technology arrives it has to struggle with the perception that the previous technology was "good enough." Fax machines were the biggest barrier to e-mail because they performed their job adequately and were "good enough" for much of what needed to be done. This relatively cheap and easy-to-use technology easily tripled the amount of time it took to adopt e-mail broadly and they still serve as an alternative today, remaining easier to use that scanners and e-mail for hard copy communication.

Laptop computers have dropped sharply in price. Desktop replacement computers like the Compaq Evo N115 and Toshiba Satellite 1900 (with a desktop P4 chip) are in line with both the cost and performance of a small desktop computer and flat-screen monitor. These machines are not as compelling as a modular design; however, they are available from a large number of vendors, have standard PC ports and represent a known risk. They also will, initially, ship in dramatically higher volumes, making them a better value for some.

There are a lot of reasons why modular computers have taken so long to arrive: cost, heat, power requirements and the lack of a sponsor that could drive standards. In Microsoft these devices have such a sponsor, but this is not a Microsoft initiative. In fact, Microsoft has two initiatives that could be seen as competing — Mira and the Tablet PC. While neither is as compelling as the modular computer (Mira is in search of a market and the Tablet PC has become a laptop computer with a touch screen), Microsoft can be very stubborn when it comes to ideas that are not its own and we do expect that behavior to some extent here.

The lack of common standards between vendors, lackluster support from Microsoft and existing products that are good enough may, over the short term, significantly reduce the opportunity for modular computers, despite the strong apparent demand for the offering.

Findings

The market for PCs continues to weaken as increasingly buyers are not compelled by marginal improvements in performance and are repelled by the aggravation associated with putting a new computer into service. Buyer needs are varied and have moved sharply away from the hobbyist source for the current generation of desktop computers. Hardware cycles have shortened from eight years to three years during the last two decades, yet the hardware design has not been effectively altered to enable this faster cycle time. In short, the market collapse around PCs is largely the result of the key vendors building to the status quo and not providing solutions that met the changed needs of PC users.

An answer to this problem would appear to be a hardware/software solution that provides for personal

flexibility and lowers the cost, both personal and financial, of moving from one platform to the next. It would allow for consistent imaging and provide for a relatively inexpensive way to keep the operating system version consistent with the hardware it was developed to support — and reduce to insignificance the switching cost experienced when moving to new form factors or technologies.

The modular computer, where the core PC technology is placed in a 4.9-inch x 2.9-inch x 0.9-inch form (slightly smaller than a Compaq iPAQ handheld computer with the CF module sleeve) and can function as a handheld, laptop or desktop computer, appears to make the most sense, particularly as the modules drop in price and Microsoft can address this new form with operating system components optimized for it. OQO will be the first to market (dimensions above are from its device) and this should effectively launch the segment.

IBM will likely follow in 2003 and both vendors plan to license this technology to others. The eventual success of this class will, to a large extent, depend on the use of common connectivity solutions like 1394 and USB, as well as the depth of support Microsoft places behind the class. (Microsoft has potentially competing offerings in Mira and Tablet computing devices and traditionally favors its own technology over that which is sourced by other firms.)

In the end, this could be the most significant change in personal computing technology. It has measurable potential to cure what ails the PC industry by lighting a fire under consumers of this technology and driving them back into stores. It is, however, all about execution, and in world distracted by current events and defined the lack of cooperation between vendors, even a product with phenomenal potential may simply not reach expectations because of the lack of key vendor support.

Recommendations

The emergence of modular computers once again reinforces our belief that we are at the beginning of a significant change in the PC industry, suggesting enterprises should anticipate change in the late 2003/2004 time frame and gate purchases, particularly laptop purchases, accordingly.

For vertical applications, sales-force support or in areas where you need a handheld computer form factor and full desktop capability, consider starting a trial with OQO or IBM (IBM is expected to have prototypes available for trial in the second half of the year). We expect the market will drive this form factor hard, so becoming familiar with its capabilities and limitations early should, at least, allow you to respond to, better anticipate and, in some cases, drive this technology in a direction that will best suite your company's needs.

If designing consumer electronics, automotive (telematics) or vertically targeted personal computing devices, consider using the modular approach and licensing from OQO or IBM to reduce design and build costs while providing a more flexible, and potentially more attractive, device to your customers.

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