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Pinpoint the next big thing(s) in handsets

Coming phones will adopt higher resolution imagers and MP3 playback capabilities, among other things.

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The worldwide cellular handset market has continued to grow, despite annual predictions of an impending slowdown because "these growth rates simply aren't sustainable." But maybe they are. The handset market can be segmented along many dimensions—air interfaces, feature tiers, geographic end-markets, and so on. Elaborate graphs and charts are generated based on extensive analysis by skilled market researchers and forecasters, but these forecasts only make sense if the underlying technologies are in place to make the assumptions work.

At the very high end of the market, "smart phones" have begun to emerge as the successor to the PDA. Smartphones usually are defined as phones with sufficient memory and processing power to run a high-level operating system such as Microsoft Windows Mobile, Linux, or similar, and in principle have the ability of feature addition through either pre-installed or aftermarket application software.

Most smart phones include a larger screen than the typical handset display, and require careful attention to backlighting and power management for battery life, and often include additional connectivity features like Wi-Fi, Bluetooth, and USB. Smartphones thus far have been limited to a small percentage of the overall market, but are expected to contribute some growth in the coming years.

There has been a lot of discussion in the industry of late regarding market expansion by means of "ultra-low-cost" handsets. These handsets, with rudimentary voice and SMS capability, monochrome (or no) displays, and no multimedia capabilities, are targeted at first-time subscribers in low-income markets and developing countries.

The current goal is a handset that can be built for $20 (or less) and sold for $30 (or less). Because a large part of a handset's cost is the semiconductor bill of materials, there's a lot of focus on reducing the chip count, using either system-on-chip (SoC) or system-in-package (SiP) technology (Fig. 1). Both approaches have their merits and will accomplish the goal. The SoC may ultimately offer the lowest silicon cost for a single handset product, but the SiP approach offers more flexibility, potential to re-use existing software, development tools, etc., across a range of models.
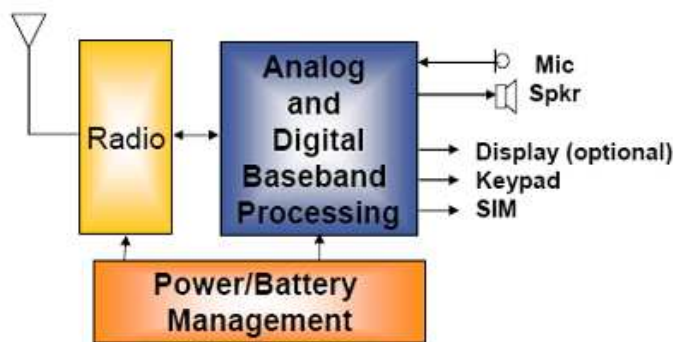
1. The key components of a basic handset are the radio, the power management, and the analog and digital baseband processing.

While the technology will naturally evolve to reduce the cost using both of these approaches, it's equally important to examine the overall cost of putting a new handset on the air. Unless the overall landed manufacturing cost (including duties, IPR license fees, manufacturing labor, and capital costs) and provisioning costs (distribution, infrastructure deployment, service, support, billing, etc.) are reduced commensurately, the ultra-low-cost handset market will be slow to develop, and alternatives such as used and refurbished handsets (with more features) will be preferred by entry-level users.

The number of used handsets will continue to grow. With the market for handsets in the vicinity of 700 to 800 million units per year and a one-year replacement cycle, this creates a potentially enormous source of low-cost handsets for emerging markets through the second-hand channel. Of course, these handsets will have been set aside in favor of

newer handsets, some of which will work on 3G networks, but the majority of which (for a few more years) will be 2.5G (or 2.75G) models.

Looking at these new replacement/upgrade handsets, what will be the next big growth drivers and what are the technologies that will enable them? For the high-end smartphone, it'll be faster, low-power microprocessors and memory cost reduction. For the ultra-low cost models, it's a lower chip-set cost combined with lower infrastructure and service costs. Finally, the feature phones will be spurred by improvements in key peripheral functions and user interfaces, as well as an optimized feature set for key user groups.

The handset market's growth in developed countries over the past few years has come in part from new services offered by the operators, but has been driven more by handsets with features that consumers value. Surprisingly, little of the attraction of new handsets at the consumer level is related in any way to the air interface or data rate supported by the air interface. In some instances, simple non-technological enhancements such as sleek casework and novel form factors have been enough, as phones have evolved in some circles of society as fashion statements or status symbols. However, it's clear that much of the attraction of newer handsets has been the addition of color displays, customizable ring tones, and cameras. Each of these features has a technology and a service component, but it's the evolution of the technology component that will likely drive the market's continued fragmentation. Operators and retailers who can align with these trends and take advantage of them will prosper.

The camera phone presents an interesting example. Early camera phones were little more than novelties, providing an opportunity to capture a moment and (when the technology worked) send them over the network to other subscribers. Last year, camera phones outnumbered stand-alone digital still cameras for the first time. And these phones have followed the lead of the digital still camera market by improving the imager's resolution from 0.3 Mpixels or below to up to 7 Mpixels in some cases.

The higher resolution opens up new possibilities for the imaging function, such as bar-code scanning, text/URL capture, etc. However, the benefits of higher-quality imagers are lost unless the rest of the optical chain (lens, focus/zoom control, image-stabilization, and image processing) keeps pace. With components becoming available for each of these blocks, new tiers of photographically-inclined users will use their camera phones instead of buying new digital still cameras (Fig. 2).
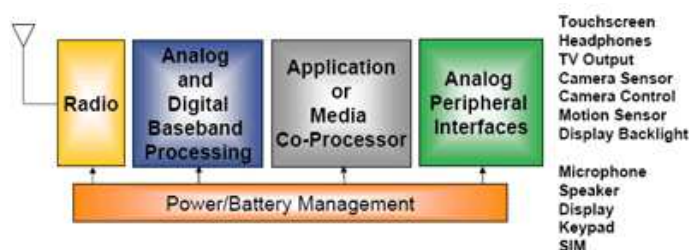
2. The key difference between the basic handset and the smart phone is the addition of a media processor and the interface to various peripherals.

Music-player phones with iPod-like capabilities are now coming to market. A gigabyte of flash memory (either embedded or in the form of a removable card) can hold a lot of music. Some early implementations of hard-disk-based music-player phones are appearing, and will become commonplace over the next few years. The processing power available in even a mid-range handset is sufficient to enable audio decoding. Some chip sets include sufficiently high-quality playback digital-to-analog converters (DACs) and headphone driver amplifiers for audio playback. There are still some system- and service-level issues to be resolved, mostly related to content control, distribution mechanisms, and rights management. These will be sorted out in due course.

TV reception is a new feature emerging in cell phones, either using the existing cellular network for content delivery or a separate receive-only channel. Decoding compressed video can either be done in software or in a dedicated hardware processing block. However, keeping the display brightly lit to watch a video clip without consuming too much power is a problem. An emerging TV-related feature is the ability to play back recorded still photos and short video clips from the phone to a TV set. This requires creating an analog video signal from the digitally-stored photo or video clip.

Gaming phones are attractive to a segment of the cell-phone-buying public. While these users may not care much about camera quality, they are intensely interested in the graphics capability, user interfaces, and even sound effects. New technologies, such as motion sensing, lets gamers interact with the handset in new ways. Music-phone aficionados, on the other hand, probably don't care much about this kind of feature.

Ironically, these new requirements for features in digital cell phones are dictating the needs for new analog functions. Examples include the analog image processing required to interface a multi-megapixel camera sensor to the digital processor, the audio and video playback DACs and amplifiers, LCD backlight controls, motion sensors, and the power-management and battery-monitoring/charging functions needed to maximize battery life while powering all the new features.

About the author
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