Solutions

phoenix technologies

Consumer Electronics Solutions

OVERVIEW

Firmware plays an extremely important role in consumer electronics devices—it drives adoption in the marketplace. Consumer electronics devices are appliances—they are devices that are expected to do a specific task well—examples include a set top box, audio-video gear, or a TV set. End users of these devices have no intention of treating them like a PC, and, quite to the contrary, are surprised when they are required to do so.

Imagine the power-on process for a Media Center PC. In decades past, anyone could operate audio gear, or a TV. You'd push the "on" button, and the radio or TV would start working. Today, Media Center PCs are central to home entertainment systems. These devices have the external appearance of a completely proprietary device that can just be turned on and controlled, perhaps with a large volume control like a radio receiver. Yet they are far from such a proprietary device; turning on one of these devices starts it "booting", a process that can take over a minute. Who would want to wait for a minute to turn on their radio receiver or TV? Consumers have little patience for device behavior that is anything other than totally responsive. Devices should never require extensive booting, blue-screen, hang, or need to be rebooted.

Another problem with these devices is how much power they consume, and how much heat they generate. Because a MCPC takes so long to boot, device manufacturers are investing in solutions that enable them to go into a suspend state like a laptop. MCPCs are not laptops, however. Using S3 to mimic the "off" state actually still consumes power, yet it gives the impression that if the power cord is pulled and reinserted, the device would continue. Of course these kinds of misimpressions can lead to unexpected behaviors, which is exactly what drives users crazy.

Phoenix Technologies has invested nearly three decades on technologies that it brings to bear on these and other problems faced by a highly competitive consumer electronics market. With quick boot times as low as 85 milliseconds (less than 1/10th of a second), high-performance wire-speed disk I/O services built into the firmware (the same I/O rates supported by high-end operating systems), and expertise in power management in confined spaces such as those encountered by electronic entertainment centers, Phoenix can make a huge difference in a consumer electronics device's behavior. This, in turn, drives adoption of the leading devices that "just work".

APPLICATIONS

Set Top Box

Set top boxes (STBs) and Set top units (STUs) receive signals from a variety of sources, including RF, cable, and even Ethernet, and then provide content that is displayed on television displays. Although originally often placed "on top of" earlier televisions, today STBs are simply another component in the audio-video entertainment center of the living room.

STBs commonly boot an operating system, so as to host applications that offer features to the end user such as a program guide and TV setup. STBs may include a hard drive, but when they do, it normally means they will have the ability to record programs and play them back, which makes them a DVR (digital video recorder) class device.

STBs, because of their consumer nature, need instant on (quick boot) and cannot crash. When running applications that can starve the OS of resources, it is possible that the OS may become confused and either blue-screen or panic. When this occurs, denial of service to the user occurs, or the device appears to "lock up". Monitoring of the OS at run-time is necessary to ensure up-time.

Another issue is field-upgradability—the cost to send out a technician to replace a unit with one containing updated firmware is high, whereas sending the same firmware over the signal network is inexpensive. When the STB can automatically query the network to determine if better firmware is available, these per-STB costs are eliminated, and a simple posting of the firmware to an FTP server can be made by the cable operator.

With Embedded BIOS® firmware, STBs can POST in under one second. Additionally, high-bandwidth disk I/O can boot the operating system and applications at full UDMA speeds, minimizing boot time. This rapid boot, coupled with Firmbase®® Technology's High Availability Monitoring solution, maximizes up-time and increases customer satisfaction. In addition, Firmbase® Technology's Platform Update Facility provides the TCP/IP-compatible, over-network provisioning that can contain firmware deployment costs and further increase customer satisfaction. Customers may never even see problems that would have needed reporting.

Digital Video Recorder (DVR)

Digital Video Recorders (DVRs) build on the STB/STU idea by adding the ability to record audio and video to mass storage; commonly this includes a dual tuner scenario allowing one tuner to spool scheduled recordings to disk while another plays media live through the TV.

DVRs also permit the user to pause the current content, even while the network continues to stream content. While the content is paused, the DVR spools the content to disk, so that when playback resumes, it is retrieved from the disk instead of the network's live feed.

DVRs have special problems because of their spooling data to disk from the network while they are also playing from disk or network. All of these problems center around performance,

because if one channel is being recorded while another is playing, then only half the CPU, memory, and disk I/O bandwidth is available for each task, both of which are real-time in nature.

The DVR's loading of work on the system increases power consumption, which drives up thermals, making a good thermal design essential for DVRs. Without this, the system may overheat, causing the CPU to throttle its performance back, causing the user interface to become sluggish, and for information to ultimately be lost either because the user can't operate the sluggish UI, or even because frames are dropped.

Using Embedded BIOS® with StrongFrame® Technology, ODMs and OEMs can tailor the power/performance operating envelope of the system to meet the user's run-time demands. This is accomplished primarily with ACPI, but also with Firmbase® Technology support that can modulate performance on-demand in the running system so as to minimize power consumption when it is not needed.

Embedded BIOS® customers can also take advantage of Phoenix Technologies' expertise in tuning north bridge components to optimize the path between the CPU and memory; memory posted write queue controls, timing, and other factors are all tunable to make the silicon best responsive to the user's demands.

Media Center PC

Media Center PCs (MCPCs) are an evolution of DVRs, adding the ability to play and manage not only video, but audio, and static pictures. MCPCs can also be extended with media center extender units, which treat the MCPC as a media server and a tuner server.

Although it would seem that the MCPC's technical issues might be centered around the additional capabilities offered to users, surprisingly, the single most important adoption issue with users is boot time. MCPCs boot like a PC, rather than an STB or a radio

receiver. They load an operating system like Windows XP Media Center Edition, and without special considerations at the firmware level can take so long to boot, the user may give up entirely on using the device to play a movie, record something from cable, or show guests some pictures.

With its Embedded BIOS® firmware, MCPCs can POST in under one second. Additionally, high-bandwidth disk I/O can boot the operating system and applications at full UDMA speeds, minimizing boot time, dramatically increasing adoption by the customer.

MCPCs have secondary issues just as DVRs have—the performance drain can be substantial to support multiple tuners, concurrent spooling of content to disk, reading from another part of disk to display delayed content, and even serving multiple media center extenders. This gives rise to unresponsive user interfaces and power dissipation problems.

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IP TV

IP TVs integrate all the capabilities of MCPCs with the idea that the content arrives from the content provider over an IP network. Thus, tuners are eliminated and the IP TV becomes a simple client on the internet. Using IP makes it possible for these clients to become active participants on the internet, instead of passively displaying content feeds and saving them to disk for later replay.

With active TV, users can access information and resources anywhere on the internet, in real time. Information feeds in the form of web pages, audio and video feeds, slide shows, multicast and broadcast events, and even new innovations made possible by the interactive nature of IP TV are possible.

As with an STB, boot time performance is critical with IP TVs, because users are unwilling to think of the power switch on their TV doing anything else except turning the TV "on". Booting is not something that manufacturers want to insert into the minds of IP TV consumers, because along with the notion of booting there is the question of "booting what", which gives rise to customers' concerns about the stability of operating systems, etc. A TV, whether IP TV, cable ready, or even analog, should simply turn on and work.

Even more so than STBs and DVRs, IP TVs need to maximize their performance and minimize their power consumption. Every watt of power consumed per second is a unit of heat that ultimately must be vented out of the IP TV, and this can cause the manufacturer to increase the performance of the heat dissipation system, which can increase noise and limit the device's aesthetic appeal in the mind of the consumer.

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