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# ***Envisioneering***

## **The Advent of Multi-Room Digital Music**



### ***An Overview of the Sonos Digital Music System***

## **Engineering, Design & Listener Benefits**

An Envisioneering Group White Paper

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## Introduction – Executive Summary

The *Jetsons* never had it so good!

Digital music startup Sonos has delivered on the promise of access to your music, anywhere and anytime you want to enjoy it throughout your home, by crafting a system that is both easy to use for the first-timer, and yet customizable enough for the audiophile.

While the appeal and value of handheld personal music players will undoubtedly continue to soar, no company has delivered on the personalization of music delivered throughout one's own home as well as Sonos. After nearly three years of refining an already good concept, Sonos has now optimized its Digital Music System into a wonderful, simple to use, expandable system, simple enough for a consumer self-installation and yet powerful enough to serve the Home Theater industry's needs as well.

Ambient music wherever you want it, delivered by a bread-loaf sized ZonePlayer which delivers much more stereo fidelity than any of the dozens of snap-on "amplifier-speaker" combinations which have recently surfaced to tap the Apple iPod phenomenon.

Well, the next wave of personal music is here, and you don't need to wear

little white earphones to enjoy it. Instead of enjoying your music on limited fidelity stereo earbuds, your favorite music can surround and bathe you, your family and friends with a full spectrum of audio, wherever they move from zone-to-zone and room-to-room in the home.

Sonos' Digital Music System can be as simple as a single ZonePlayer, controlled and configured through any PC or Macintosh, or as personally luxurious as its optional, cordless, handheld controller which can summon up any or all the music anyone has digitally stored throughout the home. The PC Controller is shipping now, with a Macintosh Controller planned for Q2 2005. Both of these provide the listener with a large screen canvas to peruse and queue up their favorite songs.

Regardless of whether a listener's music is on a PC, Mac, or dedicated shared hard drive, or libraries of songs belonging to various family members, Sonos allows multiple streams of audio to flow over wired or wireless networks. That allows all rooms to play a single musical selection, or each room to surround its listeners with a custom playlist. Up to 32 different zones, each playing the same music – synchronously from zone to zone – if desired, or, up to 32 different digital regimens, playing independently.

The Sonos CR100 wireless handheld Controller features a wonderfully simple jog-dial (using scroll wheel technology) which allows instant access to countless songs, while allowing fast selection and album art references to quicken visual access. The scroll wheel makes single-handed navigation and selection easy.

The foundation of all Sonos Digital Music System components is the simple elegance of the entire system. Both the powerful digital network music amplifier components and the music selection interface combine to make music selection easy – whether the listener is more comfortable working on a PC screen or the convenient CR100 handheld, color-screen controller.

Behind the scenes, the Sonosnet architecture does all the heavy lifting. Playlists can play synchronized across multiple rooms, or be individually different, zone to zone. Music can be plucked from networked disk drives, PCs, Macs or from Internet streams – net radio stations or soon, Real Networks' popular Rhapsody subscription service.

Trying to deliver affordable, customized music anywhere in the home has

been a daunting, expensive challenge for many years. A few "home theater" level manufacturers (including Escient, HP, Sony and others) have tried to deliver centralized music jukeboxes with multiple "receivers." Before the advent of personal digital music libraries, consumers needed to link CD jukeboxes to complex multi-room digital music systems (such as Sony debuted in 1990) or to rely on single-point, tabletop CD stereo sound systems in each room. These treat a homeowner's rooms as if they were individual hotel rooms, not zones within a home.

Most recently, a variety of PC-based music aggregation and media remote systems have debuted, but these are still far from being "plug and play" nor is consistent music quality delivery their strong point. In contrast, Sonos is delivering on the promise of your music – and your other family members' music – anywhere, anytime, without having to wear headphones or be limited by any portable players' physical controls, miniature speaker size or limited hard disk drive capacity.

The Sonos Digital Music System is friendly and supportive to PC and Macintosh music collections but is most definitely not PC dependent. For that reason, Sonos can capitalize on advances in PC music handling while not being bound to any single PC vendor or to try to appeal to PC-savvy music lovers alone.

Rarely has *Envisioneering* enjoyed the privilege to meet with smart system, electronics and industrial designers and patient marketers who have had the determination to go back to hone a wonderful product to make it even more powerful and elegant before launch as the Sonos team has.

We have every confidence that a year – and five years from now – we will also be praising new extensions and product embodiments of the Sonos Digital Music System which commences shipping this month.

## Overview - The Sonos Digital Music System

While the first product concepts of centralized digital music "hubs" debuted four years ago, feeding music packets to other hubs and "satellites," it now seems SONOS is poised to change the way people listen to personal music throughout their homes as radically as the iPod raised the concept of personal portable music.

Indeed, once you have experienced Sonos' ability to deliver any or all of your music, anywhere you want in your home, the private cozy world of iPod headphones may never be quite as appealing again.



*The Sonos Controller CR100*

To *Envisionering*, the many features and underlying technologies of the Sonos Digital Music System make for a true 21st Century digital media home run. The Sonos approach is PC friendly, Mac friendly too, but definitely *not* PC dependent. This affinity for the PC, without being dependent on the PC, makes the Sonos solution attractive to millions of homes where the PC has no place in digital music.

To access, cache, select, queue up and render digital music to as many as 32 ZonePlayers, Sonos exploits a host of embedded, well-hidden, advanced technologies. To the more technical among us, the Sonos Digital Music System taps into a cutting edge technology known as wireless mesh networking – a technology born from distributed, mission-critical computing. The music processing and network communications workload is seamlessly distributed amongst the ZonePlayers. This delivers consistent

sound quality while not limiting the wireless reach of the network to the base station as many rival systems are constrained.

If you live alone in a one-room apartment or college dorm, the full power and benefit of the Sonos Digital Music System is probably not the ideal system for you. Instead, just attach an audio amplifier or FM stereo transmitter to your iPod or MP3 player and rock on. Yet, if you do have small quarters now, and plan on a larger homestead, you might still invest in a Sonos system knowing that you can expand it at will anytime you wish.

If you live, play and work in multiple rooms, you will find that the Sonos Digital Music System changes the way you move around. By being able to have your music surround you as you move to multiple rooms, you will find it changes the way you relax. It allows you to queue up different music playlists. One favorite playlist for exercising, another for preparing a meal, background music for one's reading or doing chores.

Ambient sound pours forth from full fidelity speakers driven by a 50-watt per channel stereo amplifier within each ZonePlayer. This is far more audio clarity and power than popular tabletop CD and FM Radio digital audio systems. Yet these only deliver music to a single room at a time. Speaker attachment is simplicity itself. Spring-loaded terminals make a strong, secure connection to each bare speaker wire. No skinned knuckles or wires stinging your fingertips, nor are technicians needed.

### **Crafting Components to “Play Well” Together**

Sonos' design value is much more than the sum of its parts. In order to be expandable enough to support 32 separate zones and more than a dozen PC, Macintosh or networked digital music sources, the Sonosnet architecture is wondrously expandable. The design possesses many “backup” engineering features to ensure consistently high quality music delivery.

As an example, each ZonePlayer has *two* wireless antennas in each cabinet, to better ensure consistent signal reach with its sibling Sonos products. This diverse antenna system adds some cost, but clearly pays off well in listener satisfaction and uninterrupted sound playback quality. Also, by exploiting Universal Time coding, Sonos music selections arrive simultaneously when played in multiple rooms; a feat which is not possible for Apple's Airport Express (only one room at a time supported), PC, Media Center and Media Center Extender approaches. (Hint: digitally delayed audio sounds *horrible!*)

## Multiple Media Sources Supported, Streamed

In addition to its native ability to stream many dozens of Internet radio sources, each ZonePlayer accepts stereo analog music via auxiliary signal inputs. That means a library of vinyl record albums, 8-track cartridges or cassette tapes (or even a local FM stereo radio feed) suddenly becomes “digitally networkable” using Sonos’ technology.

No PC software, web sites or MP3 conversion programs are needed to access analog music sources. In fact, one ZonePlayer input can also be a Public Address system, or an amplified audio monitor for a baby’s room or sound monitor in a loved one’s room. That stream and that stream alone can follow a listener to any or all Zones, delivering peace of mind via immediate selection from the music button on the CR100 Controller or PC Desktop Controller.



*Samples of Sonos CR100 Media Access Screen Menus*

Music may be sourced from any combination of up to 16 separate PCs, Macs or Networked Attached Storage (NAS) drives containing MP3, WAV audio, WMA or AAC (MPEG 4 audio) music files. (These must be restriction-free music files. The majority of consumers’ music is today). Analog and digital music sources (CD players, LP record players, cassettes, 8-tracks, TV) can be attached to the auxiliary input jacks of any ZonePlayer and accessed

throughout the system as digital content. Even portable digital audio players can be attached – using a stereo headphone to RCA jack cable.

In *Envisioneering's* testing, we came nowhere close to the Sonos queue size limit of 30,000 some tracks. 70 Internet Radio Stations streaming MP3 audio are available to any ZonePlayer owner at launch. More stations and sources are anticipated.

### **Making the Complex Simple - and Easy to Enjoy**

The finest engineering and design elements, are those that appear both natural...and magical. Sonos might well have shipped products much earlier. Yet, it appears constant feedback from early adopters and testers, coupled with a design and management team that listens well, has resulted in a steady improvement in the Sonos Digital Music System, since *Envisioneering* first encountered them in late spring 2004.

That penchant for perfection has paid off. Subtle performance and responsiveness improvements were made throughout the summer and fall, leading to a system which works great at any scale of deployment. From a pair of ZP100 ZonePlayers and a single controller to a system large enough for any of Donald Trump's mansions, the system actually gets better as more zones are deployed. Contrast this with many 802.11 wireless and Ethernet cabled music delivery rival products where the addition of each player or source tends to slow down and diminish the overall experience.

### **Zone Player Robust Design**

Each ZonePlayer weighs ten pounds and packs in a whopping load of digital audio electronics intelligence, cloaked in consumer convenience about the size of a desk-sized dictionary. A four-port Ethernet 10/100 switch. Wireless capabilities to reach other ZonePlayers. A switchable international power supply, permits operation anywhere in the world.

After a day of running at full duty, the ZP100 ZonePlayer runs cool to the touch, a testament to its engineering design. The odds are you do not own another piece of audiovisual equipment as solid as this unit's design and construction, based on a cast aluminum chassis.



*The Sonos ZonePlayer ZP100*

### **BYOS (Bring Your Own Speakers)**

If you love fine recorded music, you probably already have one or more sets of good speakers throughout your home. Sonos' ZonePlayers support almost any speaker available, delivering 50 watts per channel into 8 ohm speaker loads.

The amplifier in each ZonePlayer can easily be labeled as a crowd pleaser, lease-buster, or both. Plenty of reserve power to drive *any* size speaker loud, clear and with no distortion, efficiently. Try as we could, we could not get any Zone player to rise above body temperature while delivering room-filling sound levels. That clearly represents plenty of sonic power in reserve.

Spring-loaded speaker wire connectors – binding posts – are used to attach each stereo speaker's wires to the ZP100 ZonePlayer. These are quality connections, no skinned knuckles or scratched skin. Just push in the connector end and insert the bare speaker wire and you are done.



*Rear Panel of the ZonePlayer ZP100*

Alternately, each ZonePlayer features a pair of RCA jacks to feed an existing stereo system – if that is more desirable. A subwoofer output is provided, delivering surprisingly good bass from most owners' existing digital music collections.

### **Multiple Music Controller Options**

The CR100 Sonos Controller or any PC Desktop Controller is used to orchestrate and ensure that the Sonos system is “paired” with one or more ZonePlayers by pressing two front panel buttons simultaneously as the controller digitally handshakes with one ZonePlayer. That prevents snoopy neighbors from piggybacking on your personal music collection and playlist tastes.

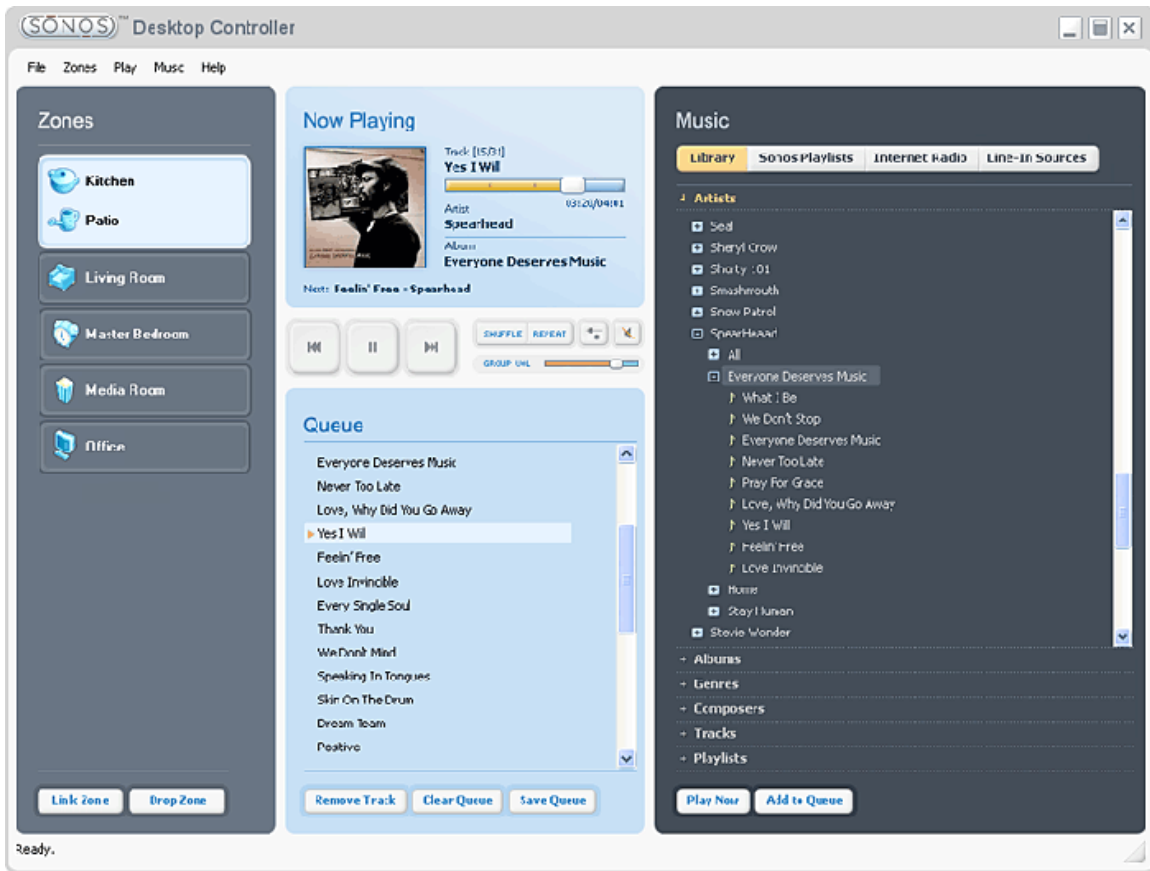
The CR100 Controller may perhaps be the finest consumer entertainment controller yet placed on the market. The 12 ounce controller uses an attractive scroll wheel, enabling rapid scrolling and selection of music titles, artists, genres, zones, music sources, everything. The scroll wheel central button allows immediate selection. How rapid? By the time you feel the button release under your fingertip, the music starts.



*The Sonos Controller CR100 speeds access through music libraries, zone selection and the creation of custom playlists from anywhere in the home.*

The 320 x 240 pixel color display (LED backlit to extend rechargeable battery life to beyond a week's average use) shows album cover art, song title and artist, timing, next selection in queue and much more.

The entire controller uses a motion sensor so that it goes into light sleep after a few minutes of inactivity. Moving the controller even a slight amount wakes it up instantly. And, we mean *instantly*. Three dedicated screen buttons align for changing screen options. Nine other dedicated buttons (rear illuminated when room lighting drops) offer immediate access to select Zones, Music Source, Play/Pause, Go Back, Go Forward, Volume Up/Down and Mute. Restoring volume triggers the sound level to ramp up slowly – no sound blasts here! A charger plugs into the top of the water-resistant controller, delivering a week-long charge in less than three hours.



*Sonos Desktop Controller offers richer music library and queue selections*

The Sonos Desktop Controller screen (on PCs now and Macs by Summer) offers larger real estate than the CR100 Controller's fine color screen; all the better for extensive music playlist assembly and selection.

## **Executive & Designer Commitments to Quality**

Discussions with the Sonos design team during the course of our initial product review and white paper creation demonstrated a passion and commitment that few startups enjoy. Sonos' founders have the talent, depth, management attitude and fortitude to support such an aggressive re-architecting of how people might most easily enjoy their music anywhere they desire. Sonos' industrial design stems from accomplished Consumer Electronics experience.



*Great industrial design of hardware and screen options doesn't just happen – it needs to be mindful at every step of engineering and manufacturing*

Our discussions with Sonos' technical management always seem to leave key design questions unanswered. But that's OK, because with that hesitation, also comes a wink – or a knowing laugh – that they have already heard a question similar to ours and were already busy answering it.

Not answering it with a quick comeback. Rather, Sonos managers are making their system better and better by listening carefully to early adopters and customers, and then reviewing all the possibilities internally, before acting. That sort of managerial confidence – and drive to make a great product even greater – is way too rare in the consumer electronics industry today. Just one of the reasons we expect to be watching this startup for many years to come.

The establishment of the “Sonos Digital Expert” category of referential experts is a good sign that Sonos will be able to secure attention from accomplished home theater installers, direct web sales and select retail partnerships alike, as well as the avid digital music fan that resides online.

### **Comments on Sonos' (Limited) Competition**

Looking back, one sees the industry's attempts at delivering whole-house AND multi-room music entertainment shows a series of staggered approaches. Around 1990, Sony offered a system which delivered CD audio tracks to multiple rooms using costly cable TV technology to “tune” into a few select CD sources. It cost more to install than many U.S. homes at the

time. Afterward, Bose and Tivoli Audio started delivery of table-top sound systems combining CD playback and radio, but these devices were not linked in any way and were simply islands of audio.

Next, the first popular handheld music player – the Rio – debuted back in 1997. It was four years before Apple would launch its first iPod product, and now almost four years later, Apple is on its fifth generation of iPod. While sales for Apple are booming, and iPod owners spend almost half as much on audio and convenience accessories as the iPod player itself, Apple has introduced three different interfaces over a short time. These might be considered as disposable, personal music sources.

In streaming and distributed music, several false-starts and premium priced systems have attempted to deliver convenient multi-room digital music access, with mixed success. *Kerbango*, an Internet streaming “radio” was a high-profile project at 3Com, yet it was cancelled scant weeks from launch almost five years ago.

During those five years, Escient and others have delivered multi-room music delivery systems which warmed the hearts of home theater installers. As well they should, as these systems require great skill to install, configure and tweak, unlike Sonos’ approach. Most of these digital music systems are not readily user updateable. Installers are needed to help expand the music libraries or to add and configure “new rooms,” whereas Sonos exploits the more advanced concept of new “Zones.”

Make no mistake - this is a beneficial, healthy business category for the top 1-2% of homes. Yet, Sonos’ ease and flexibility is likely to rapidly encroach on many of the existing multi-room music delivery systems while also empowering average audiophiles and music lovers to purchase Sonos systems for self install and self configuration.

Two years ago, the “ghetto blaster” design Philips *Streamium* shipped. This spring, Philips tries with a new *Streamium* system, yet as svelte as its design lines are, the system is dependent upon its own limits of internal hard drive space and plays back its music through a handheld stereo speaker/remote control combination device. Streamium’s current design implementations are very limited versus the Sonos distributed ZonePlayer approach, so much so that true comparisons fail.

## **A Look Ahead**

Thanks to the basic design and extensible nature of the Sonosnet architecture, the ability for a PC to deliver extensive music library and playlist control, along with the power of the CR100 Controller for direct file and playlist manipulation, *Envisioneering's* opinion is that Sonos will enjoy a design and market lead in multi-room distributed digital music enjoyment for some time to come.

The extensibility of the system has already been endorsed by Real Networks' agreement to supply Rhapsody playlists and music content to Sonos later this winter. While this is the first new digital media carriage deal announced with Sonos, it is likely not to be the last. We expect the company's combination of intellectual property – both patented and trade secret – will see many other product, device and media companies seeking to do business with them through this decade.

Is the Sonos Digital Music System completed? Not hardly. How much more will Sonos designers and managers extend the system? We don't know...but we'll be eagerly listening. We are confident we will not be alone in our anticipation and enthusiasm for the Sonos team's next performance.