PC MAGAZINE PRESENTS

EXTREME Guide to the iPod

ZIFF DAVIS MEDIA

EXTREME Guide to the iPod

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iPod photographs Courtesy of Apple.

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Know your iPod.

By Adam Gillitt

Apple's first iPod was released in late 2001, with a 5GB hard drive for $399, and was only compatible with Macs with FireWire. The scroll wheel physically rotated around the central hub, and the buttons were located on an outer ring. In early 2002 a larger 10GB version debuted for $499 and introduced new PDA-like features.

The second generation of iPods was introduced in the middle of 2002 in 10 and 20GB sizes, with basically the same case design, but with a new touch-sensitive scroll wheel, PC compatibility and lowered prices: $299 for 5GB, $399 for 10GB and $499 for 20GB.

The first limited edition iPods, 40GB engraved with the signature of Beck, Madonna or Tony Hawk sold for $548.

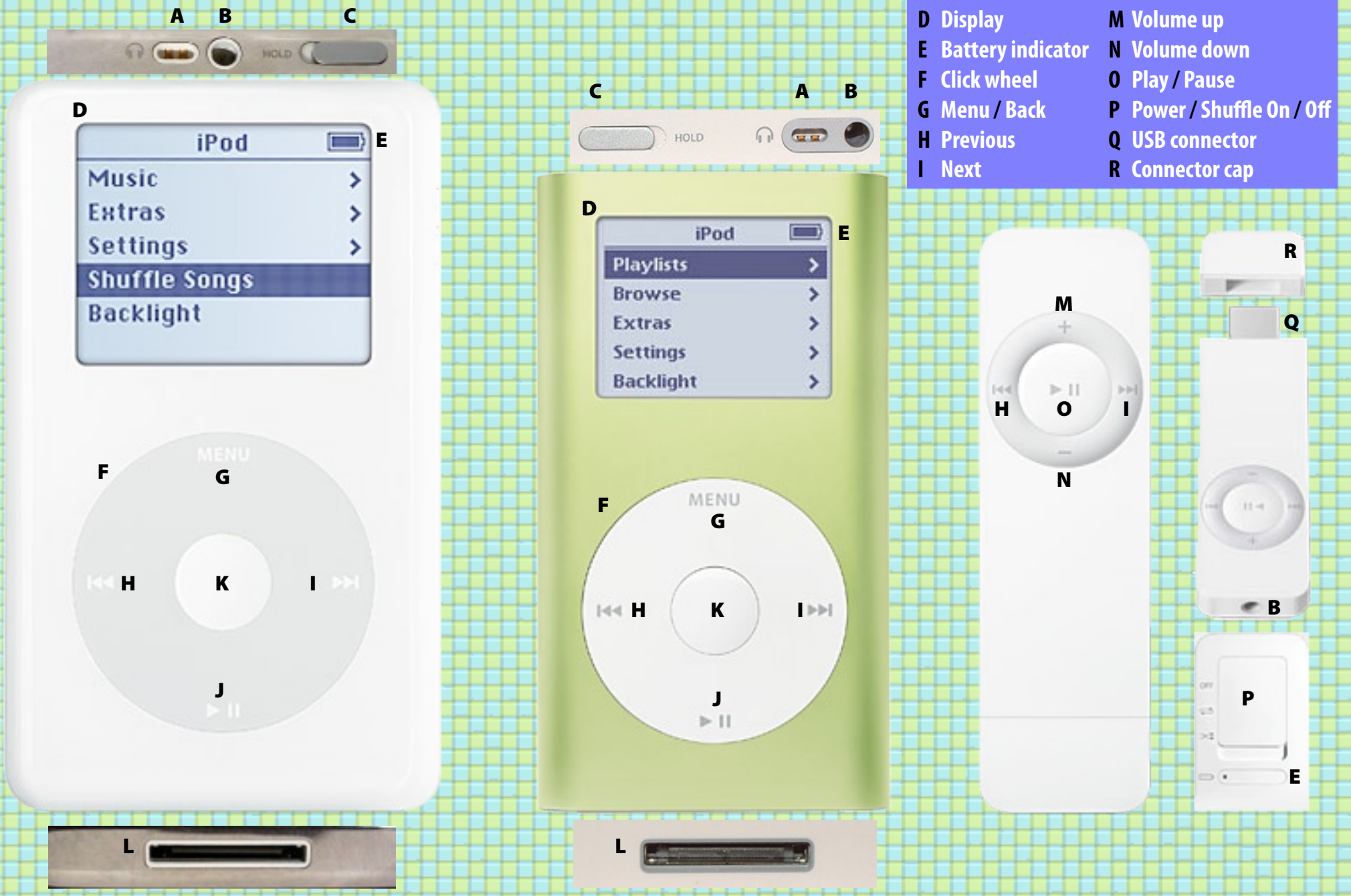
In Q2 of 2004, the third generation iPod bowed. The new case was rounded, with relocated controls that were touch-sensitive, and introduced the Dock connector, which allowed connections via either FireWire or USB 2.0. Sizes and prices were 10GB for $299, 15GB for $399 and 30GB for $499, Later in the year, the two larger iPods were increased in size to 20GB and 40GB respectively.

Macworld, in January of 2004 saw the birth of the **iPod mini**, a business-card sized, 4GB capacity player, available in 5 colors for $249. The mini also introduced the click wheel, making the scroll wheel's compass points double as clickable buttons. The 10 GB iPod was increased to 15GB. HP reached an agreement with Apple to sell the iPod under their own brand name.

Q3 of 2004 saw the introduction of the **fourth generation iPod**, with the clickwheel of the mini and the case design of the third generation. Only two models were offered this time, a 20GB for $299 and a 40GB for $399. However, in Q4, the **iPod photo** was announced, with a color screen and the ability to store and display photos, in 40GB and 60GB sizes, for $499 and $599 respectively. At the same time, a **special black edition** of the 20 GB iPod was released, with a red click wheel and the signatures of the members of U2, for $349.

Expanding the family even further at Macworld in January, 2005, Apple launched the **iPod shuffle**, their first flash-based player in 512MB and 1GB sizes for $99 and $149. The pack-of-gum-sized players sported a spartan interface with no display and a simplified control pad. Users could choose to listen to their songs in order or shuffled randomly with a switch on the back. It connected to a Macintosh or PC via a built-in USB 2.0 plug. Equal parts music player and fashion accessory, the iPod shuffle also featured a lanayard in the USB connector cap, but ommitted the PDA features of its larger siblings.

Apple maintains a useful page that will help you **identify which iPod** you have.


A Remote jack
B Headphone jack
C Hold switch
D Display
E Battery indicator
F Click wheel
G Menu / Back
H Previous
I Next
J Play / Pause / Power
K Select
L Dock connector
M Volume up
N Volume down
O Play / Pause
P Power / Shuffle On / Off
Q USB connector
R Connector cap
HOLD
iPod
Music
Extras
Settings
Shuffle Songs
Backlight
MENU
Playlists
Browse
Extras
Settings
Backlight

So you own an iPod– what next?

By Ian Betteridge

(*Note: This article mostly applies to hard-drive based iPods. The new flash-based* Ipod shuffle *functions only as a music player and solid state drive for transporting files.*)

Every gadget has a honeymoon period, and the iPod is no exception. For a few weeks, or a few months, you and your iPod are inseparable. You'll go everywhere together, do everything together, and delight in the joy of having all your music with you all the time.

What you might not know if you're a first time iPod owner is how much more you can do with it. Apple's little hard-drive-based music players are, in fact, tiny computers – and the iPod has become a platform which third party developers have built software and hardware for.

Apple itself has recognized this, by building in applications which take the iPod beyond playing music. If you're using a Mac, you can also easily synchronize your Calendar and Address Book using iSync, software that Apple bundles with Mac OS X to synchronize not only the iPod, but also any Palm handhelds or Bluetooth-equipped mobile phones you have to hand. This lets you use the iPod as a kind of mini-PDA, carrying around contacts and appointments with you wherever you go.

But what if you're using a PC running Windows? Is there a way you can take advantage of the calendar and address book on your iPod? The answer is "yes"

– although it's not as easy as the Mac, you can get information from Outlook to your iPod in one of two ways. The easier option is to check out the Windows version of **PocketMac iPod Edition**, which will automatically transfer your Outlook calendar and addresses to your iPod. However, you can also do it yourself, manually, if you want to save the additional money.

If you have an iPod, this ability to store all your personal data means you can leave your Palm at home. But, when travelling, you can also leave your travel alarm clock at home – thanks to the ability to use the iPod as for your wake-up calls.

Many users also forget that, at the heart of every iPod, there beats a miniature hard drive capable of storing gigabytes of data, and helpfully Apple has built in the ability to use the iPod as an external hard drive. This is a great way to get large amounts of information back and forth between computers quickly, as well as an excellent way of keeping a mobile backup of important data when you're on the road.

But what if you want to use your iPod in this way with both Macs and PCs? Because the two platforms use different formats for their hard drives, you'd expect that they won't work together that well. Although it's easy to convert your iPod between Windows and Mac formats, you lose all your data in the process, meaning you'll need to back up anything that's on their and re-sync your iTunes library.

Usefully, if you format the iPod as a Windows drive, the Mac will recognise it. But what if you want to keep it as a Mac formatted volume? Help is at hand in the shape of **XPlay**, a great piece of software which allows any Windows PC to read and write to a Mac-formatted iPod. It's also a good way to use an iPod with Windows 98 SE, which isn't supported by Apple.

Add it up.

Once you've begun to discover how much more you can do with the iPod, you'll want to invest in some of the many gadgets and add-ons which allow you to take things further. If you're a digital photographer, for example, **Belkin** sells **a widget** which allows you to pull images directly from a Flash card onto the iPod for storage – and it doesn't have to be an iPod photo. (Of course, you won't be able to display your photos unless you are using an iPod photo.) Or, if you want to record audio notes on the iPod, **Griffin**'s iTalk remains a great solution.

Belkin, Griffin and others also offer a variety of products to connect your iPod to your car stereo. FM transmitters are particularly handy for listening to your iPod in the car, but be sure you choose one that allows you to select FM frequencies (like the Belkin TuneCast II) so that you can find stations in your area that are not already in use. Griffin recently introduced the SmartDeck, which maps the iPod's controls to your car stereo controls. Or, you can get a simple cassette adaptor from your local electronics retailer. Many companies now offer in-car chargers like the FlexDock from **Ten Technology**, as well as units which both charge the iPod and allow music to be played over the car's speakers, like DVForge's **PodBuddy**.

Car manufacturers have begun to include optional iPod connection kits in their cars, including **BMW**, Volvo and **Mercedes**, while car stereo manufacturers, including **Alpine** and **Clarion**, plan or have released car stereos that connect to and control your iPod.

You can control your iPod from across the room, using Ten Technology's NaviPod or Griffin's AirClick. Griffin has also released the BlueTrip, which connetcs the iPod to your stereo via bluetooth, and allows you to use the iPod as its own remote.

NaviPod, from Ten Technology.

If you're using your iPod a lot— and you probably will— you'll want some way of protecting it. There are many cases around to keep your player from getting scratched, including high quality products like **Bellagio Designs**' cases or **Speck**'s Skin series (with sizes including the new iPod shuffle), but if you want a simple and cheap way of cutting out the scratches

then products like **TrendyGeek**'s **Pod Shields** are a very good choice. But for the ultimate in protection, you'll need to wait a while for **H_20 Audio**'s SV-iPod – a case designed for surfers, skiers, and other extreme sports enthusiasts that will protect your iPod from water while letting you listen to your music.

Whether you care about scratches or not, though, you'll care about the quality of the audio coming out of your iPod – and this is one area where Apple hasn't set the world on fire. Although the headphones that come with the iPod are adequate, they lack bass and – if you have anything but the perfectly shaped ear – tend to fall out at annoying moments. You could invest in a decent set of headphones, or in Apple's own in-ear option, but the most cost-effective way we've seen of improving the audio from your iPod is **Griffin's EarJams**, a small set of rubber caps for the bundled Apple phones which add bass and make them more comfortable to use. However, since all iPods have standard audio-out jacks, you are free to use any headphones you like.

If you prefer to hear your music out loud, several companies are now offering speakers with a dock incorporated to plug in an iPod directly-- some even charge the iPod while it is docked. **Bose** offers the SoundDock, **JBL** sells both the OnStage and OnTour, and **Altec Lansing** has come up with the inMotion series.

There are other add-ons available, ranging from a combination laser pointer and flashlight from Griffin to arm-bands from Apple to firmly anchor your iPod during a rigorous workout. An upcoming dongle called the **JamPod** that allows you to play your guitar along with the music through the headphones, while **SendStation** sells PocketDock adapters that allow for a variety of USB, FireWire and Line Out connections. You can find these and other useful add-ons on **our iPod accessories page**.

Apple iTunes 4.5 iTunes Music Store.

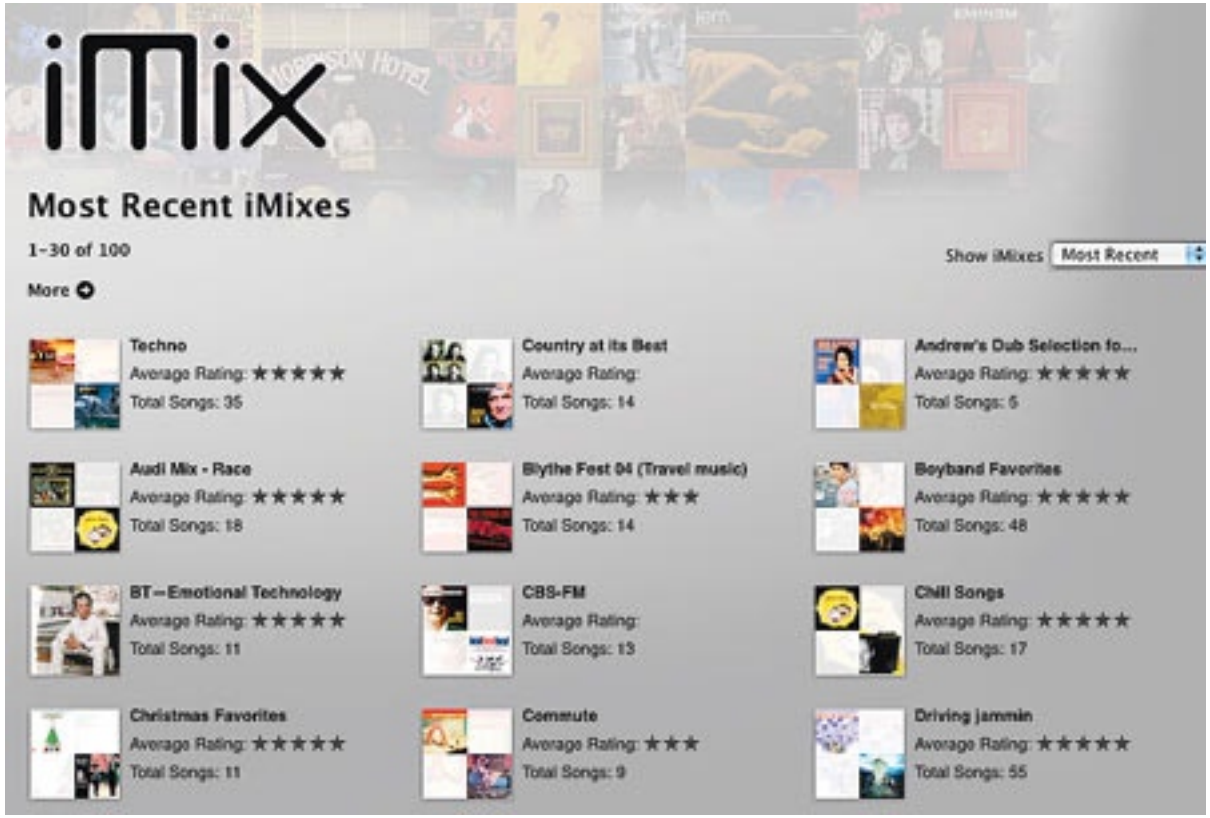
By Troy Dreier

Over the span of about a year, Apple's iTunes Music Store has gone from being a concept to being the dominant player in online music retailing: It commands over 70 percent of the market, has sold 200 million songs in its first year of operation, and now offers over 1,00,000 tracks. Apple frequently updates its iTunes utility, letting buyers make better use of the store and the tracks they purchase there (as well as the ones they rip from their own CD collections). But while iTunes is still a top-tier player and store, the improvements in 4.5 turn out to be less interesting in practice than they are on paper.

The feature likely to get the most attention is iMix, a way for you to create song playlists and then upload them to the iTunes store. Other users can then browse and even rate your playlists. It sounds like a good way for the store to add community features, something it sorely lacks compared with Napster 2.0 (our current favorite online music purveyor). While it may be fun after future improvements,

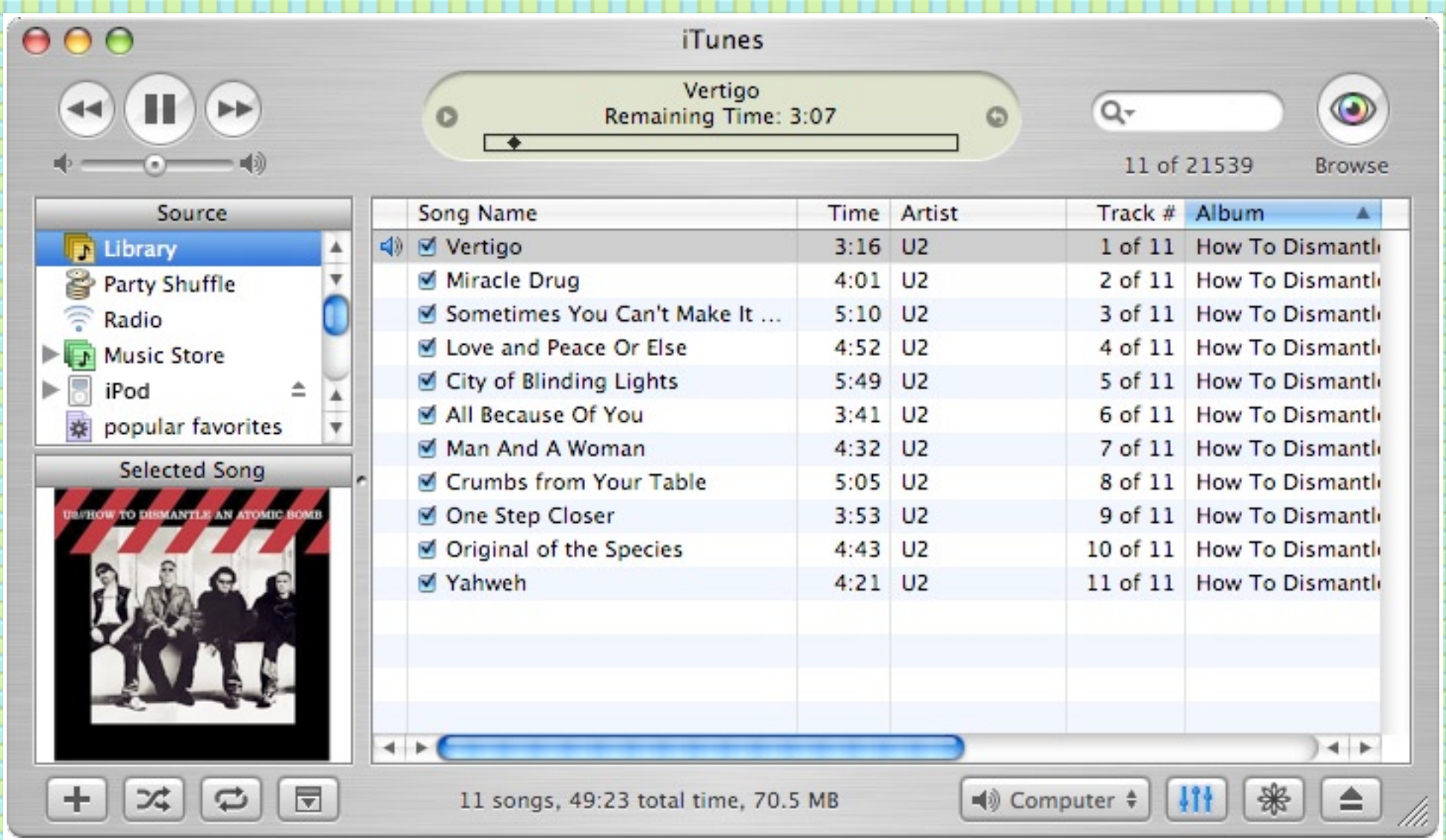
iMix is less than thrilling so far. Looking at other people's song lists isn't all that fascinating, and there's no way to post comments on mixes; all you can do is rate them from one to five stars.

Also missing the mark slightly is a new tool called Party Shuffle, which lets you generate a playlist of random songs. We love that it shows the last songs played and the songs upcoming, and that it's easy to add songs and reorder them. But the customization options need work. You can select only one library or playlist where songs should come from and can opt to have higher-rated songs play more often, but that's all. To be truly useful, Party Shuffle should offer more control over which artists, playlists, or genres should or shouldn't be included.



iTunes finally delivers jewel-case printing with this release. The feature is easy to use, but here again, customization is lacking. You can print a "mosaic" insert with small images of the cover artwork for your CDs or a plain text insert. The mosaic inserts looks extremely professional, but there's no way to adjust what you get. It's a one-size-fits-all option that's leaves no room for creativity.

Apple 's iTunes Music Store offers clear navigation that makes finding songs as easy as shopping in a well-laid-out real-world music store. Downloads are high-quality 128-Kbps AAC files, which to our ears sound nearly as nice as 160-Kbps WMA files. Songs you purchase are yours forever and can be played on three computers, transferred to an iPod, and burned to CD an infinite number of times (as long as the playlist a song is in changes after every ten copies).



The catalog now contains over 1,000,000 songs and includes content from all five major labels and over 200 independents (the service didn't have any indie content when first launched). The store includes playlists of favorite songs compiled by celebrities like Moby and Sting. And in addition to music, you can browse 5,000 audio book titles from Audible.com to play on your iPod.

A pleasure to use, iTunes Music Store made searching and finding songs the easiest among the three other online music services we tested. That said, to

stay competitive, the store will need to add community features. Without them, it feels sterile—like a lovely, well-lit superstore after closing time.

Thankfully, iTunes Music Store is also a strong jukebox. You can rip CDs into AAC or MP3 formats, burn CDs, and create playlists (including smart playlists, which add relevant songs as titles are added to your library). If several computers on your local network are running iTunes, you can turn on sharing to see and play each other's libraries.

Windows users with WMA song libraries will appreciate a new feature that converts those tracks into AAC files (which can be played on iPods). It works well, but only on WMA tracks without digital rights management (DRM)—meaning that songs you've purchased elsewhere online can't be reencoded. Audiophiles will love the new lossless encoder, which imports tracks with the same quality as uncompressed CD audio but keeps file sizes reasonable.

New offerings in the iTunes Music Store include radio charts (which show what songs are hot on stations around the country), a dedicated music-video section with an expanded number of videos, movie trailers viewable within iTunes, the ability to save the Music Store's 30-second previews to your computer, and free weekly song downloads.

Apple is also changing the digital rights on purchased songs with this release. Users who buy songs on the iTunes Music Store can now play them on five computers (up from three), but can only burn a playlist to CD seven times (down from ten). So while iTunes 4.5 isn't a must-have upgrade, it does enhance an already outstanding digital music package.

(*iTunes current version is 4.7. Changes since this review include the ability to show duplicate tracks, support for AirPort Express and new iPods, almost a dozen international iTunes Music Stores, and other performace tweaks.*)

iPod Tips and Hacks.

Use Contacts and Calendar with Outlook • Reset Play Counts • Make a "Freshest Tracks" Playlist • Create Gapless Music CDs • Go to Sleep and Wake to Your iPod • Run iPod Diagnostics • Keep Your Music CD Quality • Using iPod's AppleScripts • Converting an iPod from Windows to Mac and Back Again • Use your iPod as an External Disk Drive

Use Contacts and Calendar with Outlook.

By Scott Knaster

Apple is very magnanimous to Windows users when it comes to iTunes, providing Windows and Mac versions that are nearly identical. But that cross-platform policy does not extend to Address Book, iCal, or iSync, programs that Mac users have for managing their contacts and calendar info, and then flowing that information to their iPods.

However, because the iPod uses standard formats - vCard for contacts, iCalendar and vCalendar for appointments - you're in luck no matter which program you use to manage your personal information. In this section, we'll discuss the most basic tricks for getting contacts and calendar data to your iPod from the most popular Windows personal information manager: Microsoft Outlook.

You can get vCards and iCalendars out of Outlook, but it's not particularly easy or obvious. There are separate procedures depending on whether you want to export just a couple of items, or a whole bunch. Here's how to put a single Outlook contact onto your iPod:

1. Connect your iPod to your computer. Choose Start > My Computer to make sure your iPod is visible.
2. In Outlook, find the contact you want to move to your iPod and open it.
3. Choose File > Export to vCard file.
4. In the "File name:" box, type the name you want the contact to have.
5. In the "Save as type:" box, choose "VCARD Files" from the pop-up list. Don't click Save yet!
6. In the "Save in:" pop-up at the top of the dialog, navigate to your iPod.
7. In the file window, which now shows the iPod's contents, double-click the Contacts folder.
8. Click Save.

The next time you disconnect the iPod, the contact you saved will appear in the iPod's contacts folder.

The procedure for putting an Outlook calendar event on the iPod is similar. It goes like this:

1. Connect your iPod to your computer. Choose Start > My Computer to make sure you're the PC can see your iPod.
2. In Outlook, go to the Calendar, find the item you want to move to your iPod, and open it.

3. Choose File > Save As.

4. In the "File name:" box, type the name you want the calendar event to have.

5. In the "Save as type:" box, choose "iCalendar Format" from the pop-up list. Don't click Save yet!

6. In the "Save in:" pop-up at the top of the dialog, navigate to your iPod.

7. In the file window, which should be showing the iPod's contents, double-click the Calendars folder.

8. At last, click Save.

You have now stored a single calendar event on your iPod. When you disconnect the iPod, go to Calendar and you should see your event on the appointed date.

This one-at-a-time stuff is OK for limited use. But what if you want to put a whole bunch of Outlook items onto your iPod at once? Luckily, you're not doomed to repeating this procedure over and over again for each item. Instead, there's a hack for exporting multiple items all at once. This procedure works for both Contacts and Calendar items, although you can't mix the two types in one export. Here are the steps for Contacts:

1. As before, be sure your iPod is connected, and that your PC knows it's connected.

2. In Outlook, go to Contacts and select all the items you want. You can use shift-click and control-click to choose multiple items.

3. Choose Actions > Forward as vCard. This creates a new e-mail message with all the Contacts you selected converted to vCard format.

4. Address and send the e-mail to a trusted friend - like yourself. Although all the vCards are right there for the taking, there's apparently no way to access them all at once except as a received e-mail.

5. Collect your e-mail in Outlook. When you look at the received message, you should see all the vCards as attachments.

6. Select the message that you sent with all the vCards. Choose File > Save Attachments > All Attachments. Note: if you use an e-mail program other than Outlook to collect your mail, it might not have the Save All Attachments feature.

7. In the Save All Attachments dialog that appears, click OK.

8. Next, you'll see a Save All Attachments file list. Navigate to your iPod's contacts folder and click OK.

You're done - the contacts have been shipped off to your iPod.

If you want to export multiple Calendar items, Microsoft makes the steps very similar, yet subtly different, just to keep us entertained:

1. Verify that your iPod is connected and visible under My Computer.
2. Go to the Outlook Calendar.
3. Most people have their Outlook calendars set up to display a graphical view. It's easier to select and export multiple calendar items if you display your calendar in a list view. To see your calendar in a list view, choose View > Current View > Active Appointments.
4. Use shift-click and control-click to select multiple calendar items. Pick all the ones you want to export to your iPod.
5. Choose Actions > Forward as iCalendar. You'll get a new e-mail message with all the appointments converted to iCalendar files.
6. Address the e-mail message to yourself and send it.
7. Collect your e-mail. Select the message you sent and nod knowingly at all the iCalendar attachments.
8. Choose File > Save Attachments > All Attachments.
9. In the Save All Attachments dialog, click OK.
10. You'll see a file list for Save All Attachments. Find your iPod, then its Calendars folder, and click OK.

That's it! You have now transported the appointments you selected in Outlook to the iPod's Calendar.

Reset Play Counts.

By Scott Knaster

iTunes keeps track of a play count for each song in its library, a running total of the number of times a song has been played.

Whenever you play a song all the way through, its play count goes up by one. Playing it on your iPod counts, too: when you sync the iPod with your computer, the iPod tells the computer how many times the song was played, and the play count is adjusted accordingly.

Play count is one of the most powerful variables you can use when building Smart Playlists. When you create a Smart Playlist that selects songs by most or least often played, iTunes uses play counts to determine which songs to pick.

Sometimes it's handy to be able to manipulate the play count directly. The easiest way to do this is to right-click (or control-click on a Mac) on a song and choose "Reset Play Count". After a confirmation dialog, iTunes returns the track's play count to zero.

This trick works just as well with multiple tracks. Select as many tunes as you want, then right-click on any of them and choose "Reset Play Count". They'll all be reset to zero.

Make a "Freshest Tracks" playlist.

By Scott Knaster

When you get new tunes from your favorite artists, you're probably excited to listen to it as soon as possible. But in the hustle and bustle of our stressful lives, we sometimes forget even pleasurable diversions like listening to new music. iTunes can help you with this problem. Just create a Smart Playlist to keep track of your freshest tracks. Here's how it's done:

1. Choose File > New Smart Playlist. You'll get the Smart Playlist dialog.

2. In the boxes that define conditions for the songs you want on the list, choose "Date Added", "is in the last", "30", and "days". You can adjust the "30 days" value depending on how aggressively you acquire new music.

3. Fine-tune your playlist. You can check the "Limit" box to keep the playlist below a chosen number of songs or length of time. If you want to make sure your "freshest tracks" playlist fits on your iPod, use the "Limit" to specify the number of megabytes or gigabytes of music you want.

4. Make sure "Live updating" is checked. This makes sure that tracks are kicked off the playlist when they get too old. Think of this as a "'freshness dating" system, like the date stamped on your milk. The dialog in Figure 5-2 shows what this looks like. Click OK, and you've got your playlist.

With a "freshest tracks" playlist, you can make sure you'll never let those new tunes slip through the musical cracks. Any time we can make computers do the remembering for us, it's a plus.

Create gapless music CDs.

By Scott Knaster

When iTunes imports music from a CD, it rips each track separately and leaves a gap between them. You can eliminate the gap between songs by using the "join tracks" feature before ripping a CD.

What happens to the gaps between tracks when you want to burn a CD? Take a look in iTunes preferences, on the Burning tab. You'll see a promising setting labeled "Gap Between Songs". This setting gives you some flexibility in burning audio CDs. You can use this setting to create CDs with no gaps between the tracks, but only in certain cases:

* You joined the tracks on the CD before importing them.

* You're burning a CD from an uncompressed format (AIFF or WAV) rather than compressed format (such as MP3 or AAC).

Unfortunately, if you create a CD from MP3, you will always get a gap between the songs. The gap is still there even if you use the "none" setting in Burning preferences, although it's tiny and almost imperceptible in many cases. The only way to ensure a gapless CD is to rip the CD with joined tracks, or in an uncompressed format (either AIFF or WAV).

Go to sleep and wake to your iPod.

By Scott Knaster

After a long night of dancing to the music in your iPod, you can use the same music and the same iPod as an alarm clock to wake you the next morning (or afternoon). The iPod includes an alarm clock feature you can use to play music at a specified time. To set it up:

1. From the main iPod menu, go to Extras -> Clock.

2. When you get to the screen that shows the current time, go to Alarm Clock.

3. From the Alarm Clock screen, choose Alarm and press the iPod's Select button (the one in the middle) until Alarm is set to "On."

4. Choose Time and press Select. Use the wheel to specify the time for your alarm. Press Menu when you're done.

5. Choose Sound and pick a playlist to be the soundtrack for your wakeup call. This only works if you're going to have an external speaker attached to your iPod when it attempts to wake you up. Otherwise, it will start playing, but you won't hear anything, which greatly reduces the alarm's effectiveness. If you're not going to have speakers attached, choose the Beep sound, which comes out of the iPod's built-in speaker.

If you have one, the Belkin Voice Recorder has a small built-in speaker you can use for making sure your alarm is actually alarming to you.

Not only can you use your iPod to wake you up, it's also handy for helping you get to sleep. The iPod includes a sleep timer feature that plays for a specified length of time before shutting down. To set the sleep timer, go back to the Clock screen and choose Sleep Timer. You can then choose from sleepy times ranging from 15 to 120 minutes before having your iPod shut itself off.

iPod to bed and iPod to rise - there must be a poem in there somewhere, or at least an Apple commercial. Pleasant dreams!

Run iPod diagnostics.

By Scott Knaster

To enter the diagnostic mode on the iPod, first of all reset it. When you see the Apple logo, hold down Next, Previous, and Select. When the Apple logo goes away, release the buttons. You'll see the coolest thing ever: a backwards Apple logo, as if you were inside the iPod looking out. If it's a 3G, you'll hear the iPod emit a little squeal, like you were pinching it. Diagnostic mode contains stuff used by engineers, technicians, and factory folks to test out the iPod.

The iPod mini is slightly different. For this model, again reset the iPod. When you see the Apple logo, hold down Select and Back. When the Apple logo goes away, release the buttons to see the famous backward Apple and get into diagnostic mode.

When you enter diagnostic mode, you get an ugly, non-iPod-looking screen with a list of eight diagnostic tests. Each test is marked with a letter, A through H. You might expect to use the wheel to select the tests, but it doesn't work. Instead, use the Next and Previous buttons to move up and down the list. Press Select to run the highlighted test. While a test is running, press Play to return to the menu. If you scroll down past test H (or up past test A), you'll see a second screen, items I through P.

A. 5 IN 1

This runs several tests in a row: LCM, RTC, SDRAM, FLASH/CHECKSUM, and FIREWIRE/FW ID. (See below to find out what they do. Note that you have to press Play twice to get through LCM.) But the real cool stuff comes after the tests finish. On a 3G iPod, you can press buttons to make noises come out of the built-in speaker. Press Previous to hear the wheel's clicking sound, Menu and Select to get two different long beeps, and Next for an effect that sounds a little like a Star Wars blaster. You can have a lot of fun walking around with your iPod, pressing buttons and staring intently at the screen as if you were doing something serious. The clicking sound makes a great fake radiation detector. Press Play to return to the Diagnostics menu.

B. RESET

This resets the iPod, just like pressing Menu and Play together, but slightly easier on your fingers.

C. KEY

This test is actually sort of a video game. You have to press all 5 buttons on the iPod within about 5 seconds. As you press each one, its name appears on the screen. If you get them all in time, you see KEY PASS. If you're too slow, you're humiliated with KEY FAIL.

D. AUDIO

When you run this test on a 3G iPod, you'll hear a Pac Man-like drumming noise if you have an external speaker connected. On an older iPod, the screen will display AUDIO 0X00000001 DONE.

E. REMOTE

This one tests the iPod remote. It's another game: you get a few seconds to press all the buttons on the remote. As you press each button, a rectangle appears on the screen in a position that corresponds to the location of the button you pressed. If you don't press them all in time, or you don't have a remote connected, you'll see RMT FAIL.

F. FIREWIRE/FW ID

This test checks out the iPod's FireWire port to make sure it's working OK. If it is, you get the comforting FW PASS message.

G. SLEEP

When you run this test, your iPod drops off to sleep. When you try to wake it, you might see the low battery icon, and the iPod might refuse to come back to life. If this happens, try resetting the iPod or connecting it to power. That should jolt it awake.

H. A2D

This one checks out the iPod's analog to digital components. The test lists sometimes-cryptic names and results for several parts, which vary depending on the particular iPod model.

I. OTPO CNT

Run this test to play with the scroll wheel. "OTPO" is engineering-ese for the wheel – it was supposed to be "opto", but the misspelling is charming, so why fix it now? When you run this test, move the wheel and you'll see the iPod react by changing the big hexadecimal number on the screen.

J. LCM

This tests the iPod's display. LCM probably stands for "liquid crystal monitor". Run the test, then press Select to see a gradient pattern on the screen. Press Select again to see a giant plus sign. This plus sign refers to the positive effect the iPod has had on Apple's bottom line.

K. RTC/CHG STUS

On older iPods, RTC tests something related to the iPod's real-time clock, the one that knows the time of day. The value sometimes changes a little, but is always small. Is it related to the clock "drift", as described in "Scary Time" in this chapter? I don't know. It's one of those iPod mysteries.

This test is replaced by CHG STUS (charge status) on 3G iPods. CHG STUS displays values indicating whether there's anything connected via USB, FireWire, or the headphone port. It also appears to show if charging power is available.

L. SDRAM/USB DISK

SDRAM tests the iPod's synchronous dynamic RAM. That's the magic ingredient that fights skip protection and prolongs battery life: music is preloaded into RAM and the disk drive spins down.

USB DISK tests something unknown and reboots the iPod into disk mode.

M. FLASH/CHK SUM

The FLASH test, called CHK SUM (checksum) on 3G iPods, examines the iPod's flash ROM. The test finishes by displaying a hexadecimal number, probably a checksum to verify the ROM.

N. OPTO/CONTRAST

The OPTO test, on older iPods only, doesn't seem to do anything at all. CONTRAST lets you fine-tune the screen contrast with the wheel, but any changes you make go away when you leave diagnostic mode.

O. HDD SCAN

This item runs the hard drive test, without the cool animation you get for a disk scan, as described in the section "Use Button Combinations". Scanning the disk takes many minutes. When the scan is done, you'll see either HDD PASS or HDD FAIL. HDD means "hard disk drive". "FAIL" means "Go get it fixed".

P. RUN IN

This last item runs a series of tests over and over, until you press and hold Play. It seems designed to make sure the iPod is ready to go after it's manufactured or repaired.

Keep Your Music CD-Quality.

By Scott Knaster

The music on a typical CD takes up 500 to 600 megabytes of storage, or about 10 megabytes per minute of music. If you stored music at that rate, it would consume a typical hard disk in a hurry. The development of the MP3 format was a milestone in the brief and recent history of digital audio. MP3 provided a way to take a hunk of music, sift through it, remove most of the data, and yet end up with something that sounds quite faithful to the original version. This process, called encoding, is what happens when you rip a CD with iTunes or any other program that creates MP3s. When an MP3 encoder gets through with a CD, it manages to produce music that takes up only about 10% of its original size, or 50 to 60 MB per disc. A companion program called (surprise) a decoder is required to play back the music. Programs like iTunes usually have both encoders and decoders (players) built in.

In 2003, when Apple opened the iTunes Music Store, iTunes added support for a new format called AAC (Advanced Audio Coding), which Apple says produces files that sound better than MP3s. When you buy songs from the iTunes Music Store, they come in AAC format. And by the way, AAC allows Apple to add some restrictions to music files, which you can't easily do with MP3 files. These restrictions are the rules imposed by the iTunes Music Store: for example, tracks you buy can only be played on three different computers, and you can only burn the same playlist to CD ten times.

The hard part of encoding music is knowing which data can be thrown away without wrecking the sound. Over the years since the invention of MP3, encoders have gotten much more clever at this key task. One way to make your files sound better is by keeping more data and throwing away less. Both MP3 and AAC let you choose to make better sounding files by increasing the data rate, or the amount of information that's stored for every second of music. The typical rate is 128K bits per second of music. You improve the sound quality by using the iTunes preferences settings to increase the rate, all the way to a maximum of 320K bits per second. The higher the setting, the more disk space you use up. But if you have sensitive ears, you'll probably be glad to make this tradeoff.

Even if you use the highest compression rate, some people can clearly hear the difference between music played from CD and encoded (compressed) on a computer. If you're one of those cursed with marvelous hearing, rather than compressing your tracks, you can suck in the original full-length music from a CD to iTunes. All it will cost you is disk space.

You can easily tell iTunes to import your CDs without compression, using the WAV or AIFF format. To do so, perform the following steps:

1. Choose Preferences from the iTunes menu (Mac) or Edit menu (Windows).
2. Click the Importing tab.
3. Click the Import Using menu and choose WAV Encoder or AIFF Encoder
4. Click OK.

From then on, whenever you insert a CD to be ripped, iTunes will simply copy the tracks from the CD without encoding them. The music will sound just like it does on CD, but it'll take up about 10 times the disk space that MP3 or AAC files do. Once you have imported WAV or AIFF files, iTunes and iPod play them happily.

How much will it cost you to keep all your music uncompressed? Not as much as it would have last year, and more than it will next year. In recent times, hard disks have gotten much bigger and much cheaper. You can now buy big disks for less than $1 per gigabyte (Gb), which means you could store the uncompressed music from about 500 CDs for about $300 on a 300 Gb hard disk.

Using Apple's iPod AppleScripts.

By Scott Knaster

Mac OS X includes a cool technology called AppleScript that lets you automate common tasks in programs. Scripts written in AppleScript are little programs that you run by picking them out of the script menu in iTunes and other applications. We'll talk about AppleScript much more in Chapter 6, in the iTunes part of this book. But there are some nifty AppleScript features for iPods also, which is the focus of this section.

Apple provides the iPod scripts on its AppleScript site. Download them from that address and put them in the Scripts menu, by putting them in the Scripts folder, which you'll find in /Home/Library/iTunes (if there isn't a folder called Scripts there, create one). Most of Apple's iPod scripts perform cool tricks with Notes. Here's a description of what the scripts do:

Eject iPod. No, it doesn't make your iPod physically fly through the air - it just unmounts the iPod so you can disconnect it. This one is especially useful when you hook it up to a keyboard shortcut, which you can do with the Keyboard & Mouse panel in System Preferences.

Clipboard to Note. This is a super-simple, really quick way to add a note to your iPod. To use it, select the text you want and copy it, then switch to iTunes and run this script. The copied text turns into a note and goes onto the iPod. If your copied text is longer than the 4K limit imposed by iPod notes, no worries: the script will automatically chop up your text in multiple notes that are linked together.

Clear All Notes. Use this script to clear out all your notes in a hurry. The script also offers to remove all Notes subfolders.

List Notes. Run this script when you want to see a list of all your notes. You can select one and click Open to see the note's text displayed in the TextEdit application. If you have a lot of notes, this can take awhile. Figure 2-9 shows an example of how this works.

MacCentral. This script opens the MacCentral web site using Safari and copies the first article into an iPod note. Because you get the source listing for the script, you can modify it for other sites too.

Printer Friendly. This one is useful, but kind of oddly titled. It grabs the text from the front window in Safari and makes a note out of it. It's called "Printer Friendly" because it works best with pages that have few graphics or links, but you can use it with any page you point it at.

Converting an iPod from Windows to Mac and back.

By Ian Betteridge

Suppose you take the plunge and swap your boring old Windows PC for a brand new iMac. Or, maybe you're tempted to turn to Windows from the Mac. How do you change your iPod so you can use it with your new platform of choice?

If you're converting from Windows to Mac, the first step is to download the correct iPod Software Updater for your iPod: you can get the right version from Apple's iPod download page. Run it while your iPod is connected via FireWire, and choose the option to Restore, instead of Update. Once this is finished, your iPod will be converted to Mac format, or, if you're running Windows, to a Windows version.

Important note: converting your iPod to another format will erase everything on it, including both music and any files on there. Make sure you have a backup of anything important before you start, as there's no way to recover anything once you've finished.

Use your iPod as an external disk drive.

By Scott Knaster

You can use your iPod as a highly portable, large-capacity external disk drive. Make sure the "Enable disk use" box is checked in iPod Preferences in iTunes, and your iPod will show up as just another disk in the Finder or Windows Explorer. Once you've done that, you can use its excess capacity to store any files you want.

There is one drawback to using your iPod this way, or for any other purpose than simply getting music from iTunes. When your iPod is purely for music, and you're using the automatic update feature, the iPod gets its songs from iTunes every time you connect to the computer. All the tunes are stored on the computer and copied over to the iPod when you sync. This means, in effect, that the iPod is just a backup device for songs on your computer.

If that's all you use your iPod for, the iPod's contents are completely disposable: you can reformat it, lose it, or cast it into the fires of Mount Doom without losing any data. Once you start keeping other information on your iPod, you have to be aware of what you've stored there, even backing up those files if you want to be sure not to lose them.

A Love Letter to an iPod mini.

By Lance Ulanoff

Late last year I wrote a column about the Macintosh and its near brush with virus trouble. I received hundreds of e-mails telling me I was nuts (and worse). Buried in that column, though, was a little aside about my admiration for Apple's industrial design prowess. No other technology company's products have elicited as many "oohs" from me—and countless others. I thought the first iMac was adorable, and the second generation with its LCD panel was spectacular.

That said, I do not own a Mac, and with much of my work focusing on the Wintel and PC industry, there's little reason for me to do so. I have some envy though for those who do, especially when new Apple products come out. Most recently I found myself ogling the Apple iPod Mini. It's sexier than the original—smaller and sleeker and it comes in a number of cotton candy colors. I know many people who own the original iPod, and they'd rather die than give it up. So while this smaller device has

far less storage space (4GB compared with 20- or 40GB), I thought it might be worth giving it a try.

The first thing I noticed about the iPod Mini is that it's almost small enough to hide in one hand. There are only two edges to the whole thing: the top and bottom. The rest is a seamless aluminum shell that wraps around the body. It weighs (3.6 ounces)—about as much as an Altoids-filled tin—but still manages to feel substantial. It easily slips into my pants or shirt pocket or I can use the nifty plastic clip to attach it to my belt (there's also an arm band accessory).

The beauty of this sultry product is only half the story. Apple has managed to craft a near flawless combination of hardware and software; the software half, of course, being iTunes 4.5.

iTunes is, undoubtedly, the premier digital music application on the market today and, best of all, it's free. I do have my small nits with it, mostly because the player, Apple's QuickTime--like those from other media player companies (Real and Microsoft)--tries to take over all media content on your PC. This is an unfortunate by-product of the tooth-and-nail competition among companies. I just wish Apple would take the high road--simply install iTunes and play MP3s and other digital music file formats within iTunes. If I double click on an MP3 file outside of iTunes, I do not expect to be asked to change the default player for all media types. That's not helpful. Just let me play the one file and move on.

I can live with this minor annoyance, because every other part of my iPod Mini experience has been so splendid. Let's break it down.

Awesome Design.

Everyone talks about the iPod Mini's buffed casing and overall style, but a big part of its elegance is the interface and controls. The interface is small but ultra sharp and very easy to navigate from one level to the next. The ClickWheel just below the screen responds not only to pressure but to your finger's movement. By gliding your finger around the dial, you can scroll up and down lists of music and increase or decrease the volume. I quickly learned how to use it without looking at the interface. I'd just reach down to my belt, where I'd attached the device, and adjust the settings with a touch and a glide. Most of the other MP3 players I've looked at are so poorly designed that you would think real people don't even test them (check out the review of TDK's wacky Mojo 1). All these buttons are virtually flush with the case. And even when I threw it into my backpack, I had only to set the Hold lock on top to keep the iPod Mini from accidentally turning on. I have heard some complaints about the style and quality of the included stereo headphones. I do not share them. They fit snugly (unlike most

every other pair I own) and generate gorgeous, rich sound. I could even pick out the bongo-playing in the background of James Taylor's "Shower the People".

Connectivity and Compatibility.

iPods are now officially for everyone—Mac and Windows users alike—and the iPod Mini never made me think twice about whether or not I could hook it up to a PC (the original iPods needed a firmware update). The package came with FireWire and USB 2.0 cables. I do have a small issue with Apple's USB 2.0-only stance. No question that version 2.0 of the connectivity option is faster and better for downloading music to the Mini, but I think Apple failed to realize how many PC users have only USB 1.1 ports. (Editor's Update: Apple states on its web site that some USB 1.1 systems will work with some iPod models, but also adds that this is not the most recommended configuration due to speed issues).

Easy, Easy, Easy.

After installing the iTunes software that ships with the player, I grabbed a stack of my CDs (of course, only those I own outright), and with iTune's guidance I ripped 72 songs onto my hard drive. That process, which took over 2.5 hours for half a dozen CDs is perhaps the most time consuming thing about listening to digital music on any player. Your alternative--and it's a very good one--is to buy digital music at iTunes.com.

Pricing and Value.

At $249, the iPod Mini is considerably more expensive than flash drive-based players (which also have lower storage capacities) and $50 more than its nearest competitor, the Creative Nomad MuVo2. And for $200 more, you can get 10 times more storage space in a standard iPod. I'd still opt for the Mini, though. The original iPod looks bulky by comparison, and the Nomad is sorely lacking in sex appeal. Four gigabytes is still enough for around 350 songs at full quality(three times more than that at a lower bit rate), and that's an excellent starting point for any digital music newbie. I thoroughly disagree with anyone who says that a 128MB flash drive is adequate for digital music. You can fit just 45 high-quality songs on such a device.

Rugged, Dependable Performance.

I've already dropped the iPod Mini a couple of times; once it slipped out of my hands and another time I was trying to detach it from the belt clip and after pulling a little too hard the device popped out and hit the floor. Apple needs to rethink that design a little bit. In both cases, the iPod Mini came out largely unscathed--some scratches, but nothing major. I'm also impressed with the device's antiskip technology,

which lets me literally run up and down a flight of stairs without even a hint of playback trouble. Anyone who tells you to steer clear of hard-drive–based players and stick with the no-moving-parts flash-drive models because of playback issues on the former is just plain wrong (at least in the case of the iPod Mini).

Hidden Extras.

I love that I can have the iPod Mini double as a very simple PDA. It can hold Microsoft Outlook contact info (up to 1,000 contacts from any info manager that can export vCards, including Outlook and the Palm OS), schedule information (and sound alarms on due dates and times), and notes. It even has some cute games on it like Brick (a Breakout knockoff), solitaire, and Parachute.

Women Love It.

The original iPod was a hit with many tech-savvy women I know, and its popularity should only increase since the iPod Mini was designed to appeal to women who may not be very comfortable with digital music and electronic devices. I know Apple got it right, because when I showed the iPod Mini to my wife and put the headphones on her ears, I saw something in her eyes I've never seen there before: techno lust. I could tell she wanted one of these things. Now when a commercial comes on for the iPod Mini her eyes lock on the TV set. She's got a serious itch for one—this from a woman who has never uttered the words "want" and "technology" in the same sentence.

In my estimation, it's time for other music player manufacturers to stop messing around, buy a few iPods (Mini and original) and analyze them top to bottom to understand why they're so good and everything else is so average. Is it that hard for Creative, Dell, and others to hire decent industrial designers?

I do have one small suggestion for this otherwise exceptional device. I would love to have an iPod Mini that supports AM/FM radio. The popular radio disc jockey who I listen to every morning regularly runs 10-minute commercial breaks. I don't want to switch stations. Instead, I'd love to just flip between the radio broadcast and my MP3 play list on the iPod Mini. I understand that it could be difficult to fit the radio antenna and circuitry inside the already compact space, but perhaps Apple can make a slightly larger model, add $25 to the price, and voilà! It's a Combo-Pod.

Now, that's a device I'd buy for myself and gladly give as a gift.

Reviews.

Apple iPod mini • Apple iPod • Apple iPod photo •

Apple AirPort Express •

Griffin EarJams •

PocketMac iPod

Edition • Anapod

Explorer • XPlay

2.0 • Belkin Media

Reader • TrendyGeek Pod

Shield • Newer Ultra High Capacity

2100mAh battery

Apple iPod mini.

By Bill Machrone

BOTTOM LINE: *A smaller, lighter iPod with 4GB storage. The standard by which all other personal audio players are judged.*

PROS: *Excellent ergonomics, large storage for small player.* **CONS:** *Won't play WMA, no FM or voice record.*

The Apple iPod is the player by which all others are judged, from the packaging to the cables to the feel of the controls. The iPod Mini's screen, though smaller than that of the original iPod, still makes you wonder why other manufacturers can't produce displays this readable. The controls do exactly what you expect, and the iPod Mini does the right thing even when you don't expect it: turning on when you plug in the headphones, for example.

USB 2.0 makes downloads to the player quick and painless. But thrilled as we are with the player, we are not similarly charmed by Apple iTunes. It ripped more slowly than Musicmatch and other managers, it insisted on playing a CD while we ripped, and it defaulted to the AAC encoder, although both defaults could be changed via settings. iTunes is incapable of displaying file types, and the volume and playback controls were somewhere between balky and inoperative. iTunes was also agonizingly slow; ripping a CD at 192 Kbps with error correction took 53 minutes. Musicmatch did this in about 15 minutes.

The iPod Mini's new click wheel, which integrates the four buttons with the scroll wheel, is actually easier to use than its predecessor. The iPod Mini can recharge from its charger or from the USB cable. Unfortunately, neither of the iPod Minis we tested could match Apple's claimed 8-hour battery life; we got a decent 7 hours, 10 minutes on our best run.

The dock is a useful accessory, and the arm band is great for exercisers. The 3.4-ounce iPod Mini has more EQ selections than any other player, and it carries over the games, calendar, and other goodies from the original iPod. You can browse for music by artist, album, song, genre, or composer and set up your own playlists.

The iPod Mini, with accessories, costs almost as much as the full-size 10GB iPod, but we don't care. If you want cost-effective, get the Creative Nomad MuVo2. If you want premium, get the Apple iPod Mini.

Apple iPod.

By Bill Machrone

BOTTOM LINE: *The Apple iPod still has the easiest interface to use and is still the most stylish player. The price is friendlier, and the player is a millimeter thinner than previous iPods—all welcome improvements that (again) make it the player to beat.*

PROS: *Thinner. Cheaper. Better battery life and controls.* **CONS:** *Still no onboard FM or recording.*

Your first glance at the newest Apple iPod is likely to cause a double-take. Is it a white Mini? Where are the buttons? As soon as you touch it, your fingers confirm what your eyes were trying to tell you: Apple has grafted the control surface from the Mini onto its mainstream iPod, making the surface a little larger in the process. Most buyers will agree that this is good news. And all buyers will agree the price drop across the iPod line ($100 less for the top-end 40GB model) is also good news.

iPod historians will note that the first-generation iPod had tactile buttons arranged around the touch wheel. Now the touch wheel is the buttons: When you press the forward, back, play/pause, and menu quadrants of the circle, you get a tactile click. The only thing Apple might have done better (for the Mini, too) is to provide an orientation dot so you can find "up" without looking when the player is in your pocket.

Although its height and width are the same, the new iPod is a millimeter thinner than its predecessor. The weight, however, remains the same, as does the chrome-plated back and the size of the screen. The new model, like the Mini, now charges from the USB connector as well as from its power plug. And speaking of power, Apple claims 12 hours of battery life, and we measured 11 hours 20 minutes in our tests—far and away the best battery life we've measured for an iPod.

There's a welcome new main menu entry, Shuffle Songs. With it, we could easily shuffle-play whatever songs or playlists we had currently selected, without menu-diving to turn on the feature. Although this feature isn't unique to the iPod, it's handy and well exposed in the interface. The effect of randomly shuffling a playlist is akin to being tuned to your personal radio station: you don't know what's coming next, but you know you'll like it.

We were eager to try Apple Lossless, the company's new compression codec. Although it does not compress files nearly as much as the MP3 codec, it promises much greater fidelity. The new players have the codec built in, and the iPod Updater will install it on older iPods. We loaded uncompressed WAV files and losslessly compressed versions of the same files, then subjected

both the original and the compressed files to our audio spectrum analyzer. We were unable to detect a difference, even though the compressed files were a third the size of the WAV files. MP3 files made from the same WAV files were half the size of the losslessly compressed files, but we could easily see the lower frequency response and we could hear the compression artifacts at lower bitrates. If you plan to drive high-quality speakers at home (rather than ear buds on the go), we highly recommend the new codec for maximum fidelity.

If you like audio books, you'll like the new feature that can speed up or slow down playback without changing the pitch of the speaker's voice. Unlike the Creative Nomad Zen Xtra, the iPod's technology works only for voice, not for music.

The new iPod comes in 20GB and 40GB versions, and you'll still have to buy third-party add-ons to get FM reception or recording. But the iPod has become a platform, and Apple counts over 200 accessories with more arriving weekly, giving the iPod expandability other players can't match.

This latest iPod is incremental progress. If your current iPod works for you, there's no need to dump it on eBay and buy a new one. But if you haven't yet joined the cult of iPod, the improvements and lower prices mean your patience will be handsomely rewarded.

Apple iPod photo.

By Bill Machrone

BOTTOM LINE: *Apple retains the iPod's famous ease of use and applies it well to digital photos, but with some odd limitations. If you want primarily a music player with the added ability to see and show photos, too, you'll be thrilled. But digital photographers will wish for more on-the-road-friendly features.*

PROS: *Color screen, photo album display, and TV output give the iPod a vibrant visual side. Navigation through albums and photos is quick and easy. TV output is excellent. Can synchronize and load new pictures automatically. Music features remain the same—which is to say excellent.*

CONS: *Cannot view JPEGs uploaded directly from a camera, only those loaded from a PC. Only one computer can update the photo database. Cannot zoom in or pan on photos. Album thumbnails are very small.*

One of the theater's most enduring slogans is "Leave 'em wanting more." And that's exactly how we feel about the new Apple iPod Photo. On the one hand, it's still the music player to beat, now with a color screen and easy-to-use photo-viewing features. But while we enjoyed the performance, we were left wanting more.

In addition to its familiar music duties, the iPod Photo stores and displays photos—thousands and thousands of them—on its 40GB ($499 direct) or 60GB ($599) hard drive and 2-inch color screen. Options in the new iTunes 4.7 let you synchronize the images in a specific folder, so that your photos are always up to date. It can also turn collections in Adobe Photoshop Album 2.0 or Photoshop Elements 3.0 into iPod Photo slideshows—a nice touch for hobbyists who have committed their photo libraries to those apps.

With the new color screen, Apple omitted a brightness or contrast control, but you can still adjust the auto-off time for the backlight. We found the display to be just a bit dimmer than we would have preferred, and the color balance is slightly shifted towards the red, but not objectionably so. (Oh, and thanks to the addition of color, the solitaire game is finally playable.)

You can arrange your photos in albums, though the album view is fixed in a 5-by-5 image grid that yields thumbnails approximately 3/16 of an inch high by 1/4

of an inch wide. It can be difficult to distinguish one image from another, especially when they have similar subjects or backgrounds. But navigating through the images is a joy. Click on a thumbnail to make it full screen, and you can quickly—and we mean quickly—scroll forwards of backwards through the library by running your thumb around the scroll wheel.

The iPod Photo stores images in an internal database in a resolution suitable to its 220- by 176-pixel screen or to a TV screen (if you connect the included audio-video breakout cable or use the S-Video connector on the provided docking base). Slide show settings allow you to control the amount of time that each slide is on the screen, turn on a wipe transition, and select one of your playlists as a background music source. The TV image is sharp and stable, and Apple claims 15 hours of music playing or 5 hours of slide show viewing from the rechargeable lithium ion battery.

Musically, the iPod Photo is identical in performance to the fourth-generation iPod, which is to say excellent. One addition: You can now view album art on the Now Playing screen.

Odd, minor limitations keep the iPod Photo from being a killer implementation. You can't zoom in or pan around your images, and you can't rotate photos; all adjustments have to be made before you download the images. If you want to store full-resolution pictures that can be transferred to another computer or printed, you have to select that option in iTunes. If you forget, you'll wind up with low-res images on the unit's hard drive that lack full-resolution counterparts.

Also, the iPod Photo insists that only one computer can be its source of photos. If you connect it to another computer it will ask you if you want to replace all of the images currently on the iPod with the images currently on the computer. There is no way to add to the photo database other than adding photos to the "home" machine and updating the iPod. Likewise, digital photographers can still use the Belkin Digital Camera Link or a card reader on the road to offload images to the iPod Photo, but you will not be able to display those images on the iPod Photo (since they do not pass through iTunes).

As a music player, the iPod Photo is still virtually unassailable. But in the growing arena of portable multimedia players, it is not king of the hill. For example, the svelte Archos Gmini 400 matches the

iPod Photo's music abilities, trumps it as a photo viewer/storage companion, and handles video to boot.

That said, for users looking for a great music player that also delivers the ability to store, view, and display photos, the iPod Photo is the latest in this line of must-have devices.

Apple AirPort Express.

By Troy Dreier

BOTTOM LINE: *If you need to set up (or extend) a wireless network and also have an iTunes music collection, the AirPort Express is a must-have addition. It works easily and flawlessly.*

PROS: *Gives you an 802.11g wireless network and a way to stream iTunes music to your stereo in one tiny, affordable device. Setup is wizard-driven and should be painless for most users.*

CONS: *You can only play music at either the PC or the connected stereo, not both simultaneously. Unlike full-fledged media hubs, there is no way to control the streaming music when you're away from your PC.*

While the Apple-watchers were busy speculating what product the company would release next, Apple confounded them all with a product type that no one has seen before: Apple **AirPort Express Base Station with AirTunes**. Think of it as a wireless multifunction device. In addition to being an extremely compact 802.11g wireless access point, it also lets you stream iTunes-resident music from your PC to your stereo, extend the range of an existing wireless network, and even share printers wirelessly.

Maybe you don't need all of those functions, but if you need even just two of them, the $129 (direct) cost of the AirPort Express is money well-spent.

The first thing you'll notice about the AirPort Express is its excellent design, an Apple hallmark. The unit isn't much larger than an iPod (3.7 by 3.0 by 1.1 inches) and plugs into a wall socket directly with no power cord. It's a breeze to carry when traveling (it weighs 6.7 ounces), offers both WPA and WEP security, and can handle 10 users at once.

Use the Ethernet port to connect the AirPort Express to your cable or DSL modem, and you have an 802.11g access point with a range of 150 feet. Because of its small size, the AirPort Express has only one Ethernet port, so you can't connect a second Ethernet cable (such as to a PC on your wired network). But by using the included software, you can easily set it up as a second base station on an existing wireless network to boost the range. Apple will only certify that this works with its own AirPort base stations; indeed, it didn't work with a Linksys router in our testing.

If this were just another (albeit more compact and more user-friendly) wireless access point, we'd be ending this review here. But Apple has gone a step further with AirTunes: the AirPort Express used in conjunction with Apple iTunes (both the Windows and Macintosh versions) to let users stream their music wirelessly from their PC to any audio receiver or powered speakers. To set it up, simply plug the AirPort Express into a wall outlet near your stereo (or another audio device), connect an audio cable between the AirPort Express' line-out jack and the input of your sound source (Apple sells a $39 Stereo Cable Kit, though any standard audio cable will work), and run the simple setup wizard.

When you next open iTunes, you'll see a pop-up selection menu in the lower right corner of the screen that lets you choose where your music will play, either at the PC or at the connected stereo. (iTunes will only play it in one location at a time, so you can't get sound from your computer and

your stereo simultaneously.) The streamed tracks are uncompressed and sound rich and full.

If that weren't enough, the AirPort Express also has a USB port for printer sharing. Any computers on your wireless network will automatically have access to the connected printer.

The AirPort Express worked flawlessly in our testing, proving itself easy to set up and use no matter what the purpose. It was smart enough to prevent you from sending audio streams to it from two sources; it notified us that the device was already in use when we tried to send a data stream from a second system running iTunes. It was also smart enough to know (and alert us) when speakers weren't plugged in.

Some may lament that the AirPort Express isn't a full-fledged media hub—letting you play and manage your PC-resident media files remotely—such as the products we've tested from Creative Labs, D-Link, Prismiq, and a couple dozen others. The biggest drawback of the AirPort Express is that you can't control the music playback (or see playlist and track info) from the room where you're listening to the music; you have to go to the PC on which iTunes is running to do any of that. But if you view the AirPort Express as a no-hassle portable access point that also lets you play your iTunes music collection elsewhere in the house, you won't be disappointed.

Griffin EarJams.

By Ian Betteridge

EDITOR RATING: ●●●●●

If there's one criticism that comes up about the iPod over and over again, it's the headphones. Like most phones of their type, the standard iPod headphones deliver a tinny sound that leaks out, and they fail dismally at the task of blocking out the sounds around you. The first thing that anyone who's more concerned with sound than looks does is go out and buy a replacement set.

Apple's answer to this of course would be for you to buy a set of its in-ear phones, which utilize rubber pieces which fit inside your ears, delivering a better level of bass, and some degree of noise cancellation. However, at $39, it's an expensive purchase when you've already spent upwards of $249 for the iPod itself, and means throwing away a perfectly good set of phones.

EarJams, from Griffin Technology Inc, are an attempt to bridge the gap between the default phones and Apple's in-ear replacements. They consist of

small plastic caps which fit over the ends of your regular iPod ear phones, and attach to rubber plugs similar to those from the Apple in-ear phones. The whole assembly then fits into your ear, and there are three different sizes of plug for different sized ear canals.

In use, they work remarkably well, at least as well as the $39 Apple phones. We found the phones had good bass, blocked out noise well, and fitted snugly, although of course as each ear is individual how well they fit will depend on your ears. But the best thing about them is the price: $14.99, less than half that of the Apple in-ear phones, and including a carrying case to protect your headphones.

Overall, EarJams are a great little solution for those who simply can't live with the sound of the regular Apple ear phones, but don't want to spend a lot of money on replacements.

PocketMac iPod Edition.

By Ian Betteridge

EDITOR RATING: ●●●●●

How many gadgets do you commonly carry around with you? A mobile phone is pretty much a given. Of course, you'll probably have your iPod with you most of the time. Perhaps there will also be a digital camera lurking in your pockets. And you may even have a PDA somewhere about you as well.

Even though the devices themselves are small, once you start carrying them all around you're going to need either large pockets or a bag. Far from looking cool, you'll look like some kind of alpha nerd.

The solution is to combine as many of the devices into one as possible, and, thanks to its flexibility and huge amount of storage, the iPod is ideal for taking on some of the load. It already has a calendar, address book, and notes, which means that you can effectively get rid of your PDA, but the features in the iSync plug in are somewhat basic, and of course are limited to Apple's own applications. If you use Microsoft Entourage, you're out of luck.

Enter PocketMac for iPod. Its maker, Information Appliance Associates, has carved itself a successful niche in synchronising Mac-based information

with devices that don't normally talk to Macs, such as the Pocket PC, and the aim of PocketMac for iPod is clearly to plug another gap that Apple has left.

PocketMac first and foremost acts as a conduit between the iPod's calendar and address book and Entourage, working via an iSync plug in. This means that it works in tandem with any other devices you're using, as well as synchronising with a .Mac account if you have one. This is important, as it removes a lot of the potential for conflicting schedules.

However, PocketMac goes much further than just acting as a conduit between the iPod and Entourage: it also synchronizes documents – including Word, RTF, and PDF - and email. As there are no native document reading applications on the iPod, it cleverly breaks the documents into 4KB chunks and displays them in the iPod's Notes application. Although this means that the product is limited to recent iPods which feature this, it's a clever solution to the problem.

Of course, this means there are a couple of limitations. You can't author or edit documents, as you could on a real handheld. Long documents can be awkward to read on the iPod's small screen, and although the program does a good job of working with 4KB chunks, linking them together in a fairly seamless way, it can till be difficult to read a long document.

PocketMac for iPod makes probably the best job that can be made of turning the iPod into a PDA. But what really makes it an essential buy for anyone wanting to stretch their iPod is the price: $23.41 is a small price to pay for what it can do. If you're an Entourage user, or simply want to do more with the iPod, it's well worth buying.

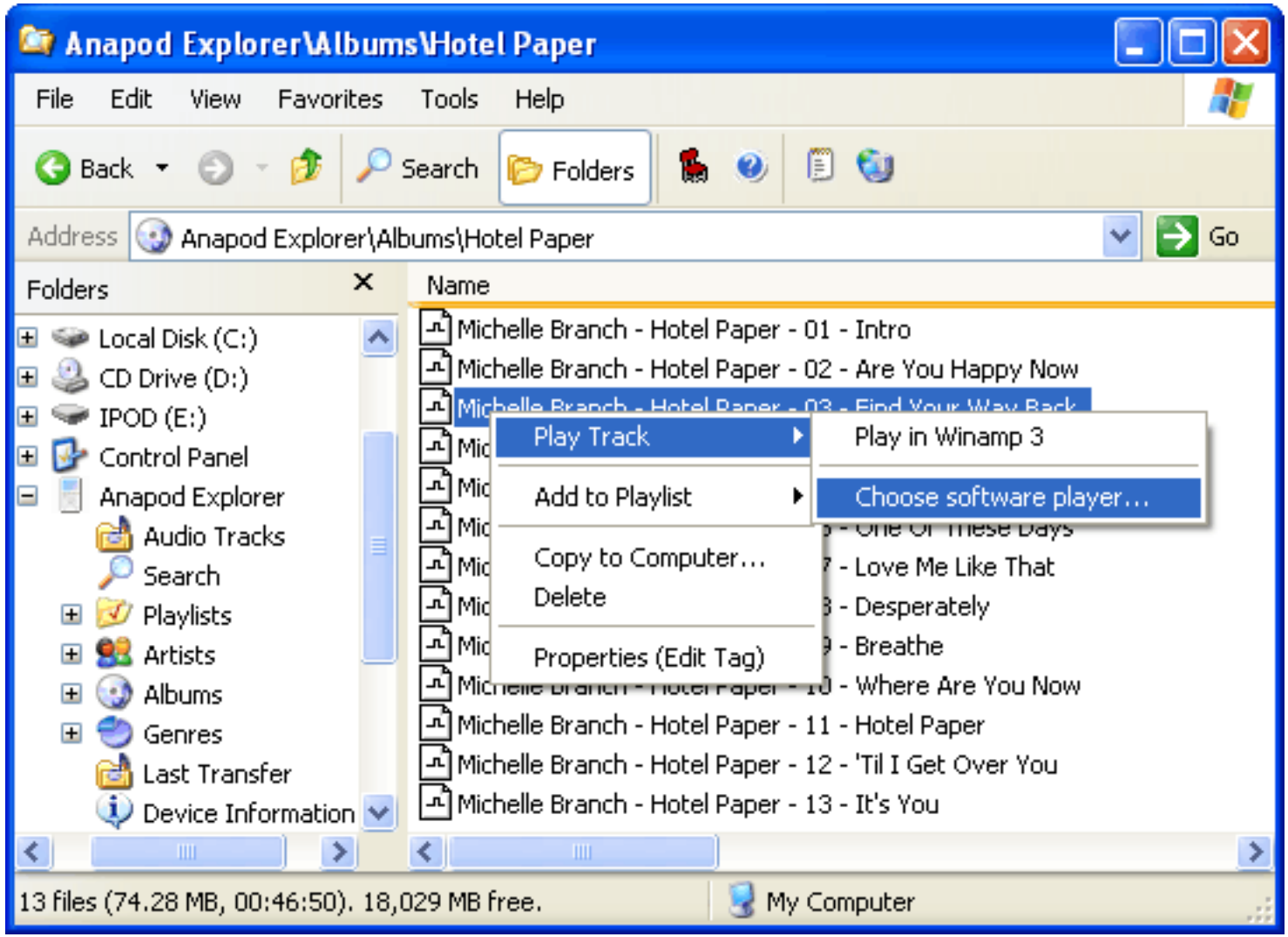
Anapod Explorer.

By Ian Betteridge

EDITOR RATING: ●●●●●

iTunes is a great piece of software for playing MP3's, with one of the most accessible interfaces built, but it's not for everyone. On Windows in particular, it looks somewhat out of place, and Apple's efforts to turn iTunes into a truly Windows-style application have been minimal at best. And, of course, if iTunes isn't your preferred MP3 player, you're simply going to be out of luck when it comes to using the iPod.

Enter **Anapod Explorer**, which is the nicest and most comprehensive piece of Windows software for getting the most out of the iPod that we've yet seen. Anapod integrates with Windows Explorer, allowing you to directly drag and drop audio files on to the iPod from any folder on the PC. Uniquely, it supports conversion of audio files from formats that the iPod doesn't understand – such as Ogg Vorbis,



FLAC, or unprotected WMA – into MP3, so you don't have to worry about what format your music is in.

However, copying doesn't have to be a manual process. Anapod's SpeedSync feature allows you to designate any number of folders as being synchronised to the iPod, so that all the files within them are transferred over whenever the iPod is connected to your PC. What's more, Anapod supports creating play lists directly within Windows Explorer, simply dragging tracks into and out of the play list at will. If you have pre-existing play lists created in any of the popular formats by applications such as WinAmp, you can also just drag the play list directly on to the iPod, and have all the tracks on it automatically downloaded. Of course, this is a two-way process: drag a play list from your iPod to the PC, and Anapod creates a new folder and copies all the tracks in that play list to the PC.

And Anapod Explorer does more than music, too: you can copy over all your contacts from Outlook with a single click, as well as creating iPod notes directly by typing on your PC. There are some other nice features too, which allow you to play the music on your iPod across a network, from any machine which supports MP3 streamed over HTTP, even allowing you to play your music through a web browser.

Our only problem with Anapod Explorer came when occassionally it would refuse to recognize the iPod. However, within less than a week the software was patched to fix this issue - and with the product being patched on average every two weeks, bugs tend not to last for long.

Overall, if you're using an iPod with Windows and you want to do more than iTunes is capable of, or you simply want the freedom to use your iPod in a different way, then Anapod Explorer is for you. Had this been $50, we would have thought it was decent value: at $25, it should be an essential purchase for anyone who can't get their head about the way that iTunes works, or just wants more flexibility when using their iPod.

XPlay 2.0.

By Ian Betteridge

EDITOR RATING: ●●●●●

For a brief period back in the dawn of iPod history, the product was effectively only for those happy few with Macs. iTunes, Apple's excellent music application and conduit to the iPod, was Mac-only, and iPod's could only be formatted as Mac-native HFS+ drives. Unsurprisingly, some companies saw this as an opportunity – and in prime position was Mediafour, which already made MacDrive, an excellent piece of software that allowed Windows users to work with Mac formatted drives. Hence, the creation of **XPlay**, a piece of software based on MacDrive which allowed users to copy songs direct to a Mac-formatted iPod from any Windows machine.

The natural question is whether there is any need for XPlay, now Apple has created iTunes for Windows and iPods can be formatted in Windows-native formats. The answer, thanks to XPlay's evolution into XPlay 2.0, is definitely "yes". For example, if your primary computer is a Mac and you want the convenience of using a Mac-formatted iPod, yet occasionally need to use the player with a PC, XPlay is an ideal solution. And, if you use Windows 98 SE or Windows Me, you'll need a product like XPlay in order to use your iPod with your computer.

What's more, the latest version of XPlay adds some convenient features, which will appeal to some. The product now converts unprotected Windows Media files on the fly into MP3s when you copy across to the iPod, although this requires that you have MP3 creation software installed. The interface under Windows XP is smooth, clean, and easy to use, integrating well with Windows Explorer.

XPlay is an impressive piece of software, both for its power and more than anything for its simplicity. For Mac users who want to use their Mac-formatted iPod with a Windows machine, it's an ideal solution that just works – and at $29.95 it's easily affordable too.

Belkin Media Reader.

By Scott Knaster

If you're a digital photographer, you probably know the hassle of running out of space for pictures on your camera. It's not like you can just carry a few extra rolls of film around with you – CompactFlash, SmartMedia, and the like are too expensive for that. Off-loading your photos to a computer is one solution, but you probably don't want to drag a laptop around with you when you're out taking pictures.

To solve this problem, you can get various portable hard disk solutions for storing your photos. But you already have a portable hard disk with abundant space – it just happens to be a music player too. So

the folks at Belkin have given your iPod yet another job: digital photo storage. All you need is a box to read the photos and move them to your iPod. **Belkin Media Reader for iPod** does the job for you. The Media Reader is a little bigger than a standard iPod and has slots for six different media types:

CompactFlash types 1 and 2

SmartMedia

Secure Digital (SD)

Memory Stick

Multimedia Card (MMC)

If you have a digital camera, it almost certainly uses one of the media types accepted by the Belkin Media Reader. That's one of the great features of this product: you don't have to worry about the competing standards when deciding whether this reader will work for you. Just make sure your camera uses one of the six supported types, which is nearly a sure thing, and you'll be compatible.

To use the Media Reader, you open the nifty sliding door that protects the media slots, then put in your card. Connect the reader to the iPod's dock connector. The iPod reacts by asking if you want to import photos from the media card. If you say you do, the photos are copied over while you watch a progress

screen on the iPod. Copied photos are stored by roll number. Once the photos are copied over, you can delete them from the media card so you can go take more award-winning photos of rocks and dirt.

Once the photos are in the iPod, what can you do with them? You can get information about them, such as the number of pictures in a roll and the type of media they were stored on. Once you reconnect to your computer, you can copy the photos over by using any software that imports digital photos, such as iPhoto, or you can copy them manually by looking in the cryptically named DCIM (digital camera images) folder on the iPod.

One thing you can't do with the photos, unfortunately, is look at them on your iPod. The iPod screen graphics capability is limited, and there's no software support for showing images on the screen. Maybe this feature will show up in a future iPod.

The Belkin Media Reader for iPod works with 3G iPods. It's sold at Apple stores, including the online store, and many other places for about $100.

TrendyGeek Pod Shield.

By Ian Betteridge

Editor Rating: ●●●●○

The iPod is a design classic. No matter which model you have, it's a pleasure to look at and use, thanks to its combination of smart good looks and simplicity. Yet it's also prone to being scratched, especially if – like most people – you keep it in a jacket pocket most of the time.

The solution of course is to get a case for it, and there are many cases which fit the bill. From metal to the finest leather, you can enclose your iPod in the kind of variety of materials that put a high-class clothes shop to shame. Yet the problem with every case we've ever seen is that, once enclosed, your iPod no longer looks like an iPod. It goes from a design classic to something that's hidden away, almost as if you were ashamed of its good looks.

However, if you want to protect your iPod without having to hide it away, TrendyGeek has a solution in the shape of its Pod Shields. These are simple, easy to fit plastic protectors for the metal back and screen of the iPod, which are design to soak up the scratches of everyday life. To say they're simple is understating it: they require no glue, clinging to the iPod via static alone, and are cut to fit all fourth generation iPods

snugly, wrapping around to cover the sides and bottom with a cut-out for the dock connector port. Each pack comes with three back and three screen pieces, allowing you to replace them when they become marked.

Fitting takes about ten seconds, and could be easier. The fact that they're cheap too – around $12.99– makes them a very good solution for anyone who wants to protect the iPod without having it covered completely. Our only minus point was that, because of the iPod is slightly curved at the top, the back protector won't quite fit flush to the iPod – something which could lead to the protector peeling off every now and then. However, given that you can simply smooth it back into place, this isn't much of a problem.

Newer Ultra High Capacity 2100mAh battery

By Ian Betteridge

EDITOR RATING: ●●●●●

If early adopters of the iPod have found out one thing, it's that the battery life of Apple's portable music player tends to diminish radically with time. If you bought an original iPod on the first day of its release and have used it regularly since, you're likely to struggling with a battery life that's perhaps shrunk to less than an hour – something which makes the product more or less useless.

Of course, you could send it away to Apple and have the battery replaced. However, doing this is a relatively expensive, so it's no surprise that several third parties have begun to offer battery upgrades which can be fitted by you. At much lower cost. One of these companies is Newer Technology, a name that will be familiar for its Mac processor upgrades. What's more, its Ultra High Capacity 2100mAh battery delivers around 20 hours of battery life to any first or second generation iPod, for less than $40.

Fitting a battery to the iPod is one of those things which is much easier to do than you'd expect. Taking the case apart is simply a matter of sliding one of the plastic tools supplied down the crack between

plastic and metal parts along the side and bottom of the player. Once this is done, you need to ease the old battery away from the drive underneath, retaining the two adhesive pads which hold the battery in place. Then detach the battery from the small cable which powers the iPod, and fit the new battery, using the old adhesive pads. Clip the metal back of the iPod back into place, and that's it – the new battery is fitted.

We tested the battery by fully charging the iPod then leaving it on to play continuously until it was totally depleted, three times. Using a random set of songs including both short pop tunes and longer classical pieces, we found the Newer Tech battery delivered between 18 and 21 hours of battery life

– a considerable improvement over the 40-60 minutes that the original battery had been managing.

Overall, the Newer Ultra High Capacity 2100mAh battery is the most cost-effective way of getting more out of a first or second generation iPod. If it were $50 it would be a bargain: at less than $30, it's excellent value for money. Even if you're still getting a couple of hours of battery life out of an old iPod, it's worthy spending the money simply to watch the faces of friends with the latest model as your two year old machine eclipses the "mere" 12 hours of battery life they're getting. The battery is available through OWC.

Newer has added a battery replacement for third generation iPods, the NuPower High-Capacity 850mAh Lithium-Ion battery, priced at around $25, also available from OWC.

Digital Audio Primer.

By Jason Cross

It seems as though there are more digital music players on the market now than grains of sand on the beach. Flash memory continues to drop in price and the electronics necessary to make a portable digital music player are increasingly commoditized. The result is a flood of affordable digital music devices from brands both large and small. This year will see the release of a slew of new digital media adapters— devices that pull audio, video, and pictures off your PC and display them on your TV. Some will even be built into DVD players or TiVo-like video recorders. With all these new devices for playing digital music, it looks like the compact disc's days are numbered.

Even if we don't throw out our CDs, it's more likely than ever that we won't actually listen to them. Instead, we'll pull the songs off, storing them on our PC or portable music player as compressed digital audio files. As the years roll on, more and more music will be purchased online in digital form. Most of us already have a lot of digital audio in our lives (beyond simple CDs), but the amount of it is set to explode.

So now let us go over digital audio terms and technologies. Most of us know a bit about the different formats and terms, but the world of digital audio is enormous and ever-evolving. What follows is a list of common and useful terms, their definitions, and a description of some of the more popular and interesting digital audio formats. There's a lot of ground to cover so let's jump right in.

When you come across two geeks talking about digital music, it can sound an awful lot like they're speaking in another language (much like listening to a baseball fans). There's a sea of terminology to wade through but much of it is purely academic and not really useful to typical consumers. Here are a few of the more common terms you should understand to get the most out of your digital audio experience.

Codec: Any time digital audio is mentioned, this word gets thrown around. It's a shortening of *compressor/decompressor*— an algorithm used to compress data and then decompress it again. Some codecs are implemented in software, some in hardware, and some are limited in their functionality. A portable music player may have a "codec" that only decompresses data, for example. However, it's common in the digital media world to call any algorithm that deals with the compression and decompression of audio data a codec.

The process isn't necessarily symmetrical— it often takes longer to compress a digital music file than to decompress it for playback. Decompression is less CPU in-

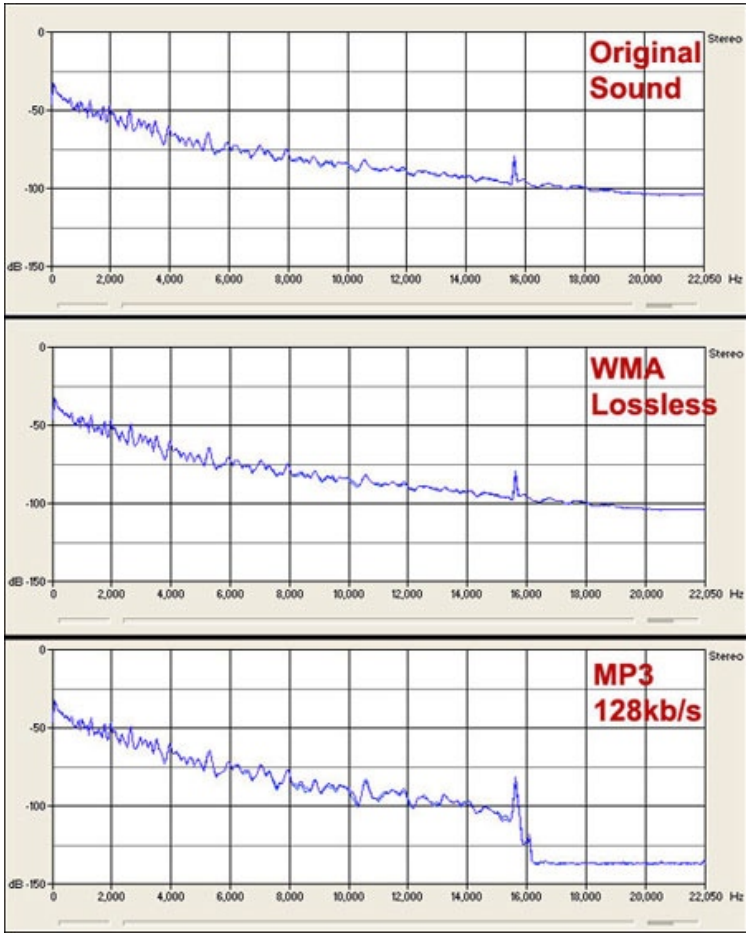
tensive, which is why tiny players with very low power processors are fine for playing back compressed music.

Compression Ratio: Simply put, this is the ratio between the size of the original uncompressed audio clip and its compressed version. If an audio clip is 20MB in its native uncompressed form and 1.8MB as a 128k MP3 file, then that file has a compression ratio of 11:1 (typical of 128k MP3 files).

Lossy / Lossless: Digital sound formats are divided into two types: *Lossy compression* is that which actually removes some information in order to make the file easier to compress. Lossy compression is by far the most popular format, because it allows for much smaller file sizes. Virtually all lossy compression schemes, whether for audio or video, work by a principle called "perceptual coding." This is the process of removing parts of the original data that the user will probably not even perceive anyway. The trick is to remove as little information as possible from the original audio sample and to make sure that which is removed is hardest to hear (frequencies above the range of human hearing, for example).

Lossless compression is just what it sounds like— a way of compressing music into a file that, when played back, is absolutely identical to the original. Not just "sounds the same," but that is statistically identical. It was once only a viable option for professionals seeking to archive large volumes of audio but now large hard drives are cheap and drive-based portable players with lots of storage are abundant, so lossless codecs are increasingly relevant to end users that want the best possible audio fidelity.

The following image shows the difference between lossy and lossless compression. We took a clip from the *Fellowship of the Ring* soundtrack and encoded it in two formats: Windows Media 9 Lossless and MP3 at 128 kilobits per second. The original clip was 10.3MB, which was cut down to 6MB with the lossless codec— not even a 2:1



reduction, but still a good space savings. A clip that is not quite so musically complex would compress further. The 128kbit MP3 cut the file down to 983 kilobytes, and 11:1 compression ratio.

Then we took a look at a spectrum analysis of the resulting files. Note how lossless compression produces the exact same graph, while the MP3 file loses signal dramatically as frequency increases and drops off entirely just over 16KHz. Increasing the bit rate can improve this, but the only way to get a totally exact copy of the music is to use a lossless compression scheme.

Bit rate (Kilobits per Second)	Seen in	Compression Ratio (Compared to CD Audio)	Three-Minute Songs per 650 megabyte CD
1411	CD Audio	1:1	20
192	High quality MP3, WMA, or AAC	7.3:1	154
128	Most downloaded music (legal or otherwise)	11:1	231
64	High-quality streaming music; small memory-based portable devices	22:1	462
8	Streaming voice; Internet talk radio	176:1	3,697

Bit Rate: The bit rate of a digital file is defined as how many bits it uses up in a given interval of time. (An audio file is almost always measured in "kilobits per second.") Typically, the higher the bit rate at which music is encoded, the better the sound is. A rate of 128 kilobits/sec is extremely popular in online music downloading— legal and otherwise— because it offers a good compromise between sound quality and download time. Here's a little chart to give you an idea of how different bit rates compare to regular CD audio.

Bit rates lower than 128kb/sec are generally not suitable for CD or hard drive-based devices, but rates between 64 and 128 are great for devices with only 64 or 128MB of memory where you want to pack on more songs, or even for streaming internet radio if the listeners have broadband connections. Very low bit rates (below 64kbps) are almost totally unsuitable for music but compress voice fairly well and can be used for online voice chat or streaming talk/news radio. Of course, there's always the option of using a variable bit rate.

VBR & CBR: These common acronyms stand for *Variable Bit Rate* and *Constant Bit Rate*, respectively. Constant Bit Rate audio files are the most common— they use up the exact same amount of data from one moment to the next. If you have a 128kb/s CBR music

file, it will use 128kilobits to describe the audio in each second of the song, regardless of what sounds are playing that second or the complexity of the audio stream at the time. A Variable Bit Rate is a bit smarter. A VBR music file will use a lower bit rate in areas of the song that are simpler to compress accurately, and then higher bit rates in parts that require more bits to describe accurately. VBR audio files are often made with a certain quality in mind, rather than a certain bit rate, but it's almost always true that, all things being equal, a VBR sound file will sound better than a CBR file of the same size. The problem with VBR is that it's hard to stream over the Internet, because the amount of data that needs to come over your net connection is constantly changing from one moment to the next.

Sample Rate/Bit Depth: These are the most basic specifications of all digital audio files, compressed or not. *Sample rate* refers to how many times per second the original waveform is translated into digital form. CD audio, for instance, is sampled at 44.1KHz. That means that the left and right channels are each sampled 44,100 times per second. Sampled into what? That's where *Bit depth* comes in. This is how many bits are used to describe each of those samples. The more bits used to encode the file, the more accurate the sample. CD audio is sampled at 16 bits, so there is a 16-bit number to describe the amplitude of the sound wave for each of the 44,100 samples every second. No wonder CD audio files are so big.

How much sample rate and bit depth is enough? Well, according to the **Nyquist Theorem**, you need twice as many samples per second as the frequency you're trying to digitize. Human hearing peaks out at around 20-24KHz, so it would stand to reason that we need a sample rate of 40-48KHz to reproduce the entire range of human hearing.

But that's only half the story. It may only take two samples per sound wave to reproduce it digitally, but the quality of taking this minimum approach is less than desirable. Bumping it up to four samples or more per wave, however, creates truly compelling audio. A sampling rate of 96KHz is used in the DVD-Audio standard and by most professional digital recording equipment. This allows four samples for each wave in the upper limit of human hearing, and six to twelve samples for waves in the 8-6KHz frequency range, where most of the music we hear is.

Bit depth is pretty good at 16 bits per sample, which is most common, but most professional audio equipment and the DVD-A standard use 24 bits per sample. More bits are good in audio for the same reason they're good in graphics. 16-bit audio allows for 65,536 different "levels" per audio sample, while 24-bit boosts that fidelity to 16.7 million. This huge increase helps

preserve nuances and overtones and prevents quantization errors when mixing tracks, in much the same way as 24-bit color on your monitor prevents the banding artifacts prevalent with 16-bit color.

Dynamic Range: In layman's terms, this is the range from the softest to the loudest sound a system can reproduce. Humans (especially children) can hear nearly 0 decibels and our pain threshold is up around 120 decibels, so we can say that humans have a dynamic range of around 120dB. When talking about digital audio, you generally have to subtract the noise floor— or amount of noise during "silence"— from the maximum sound output the system is capable of producing. In the digital realm, it's generally accepted that you get about 6dB of dynamic range for each bit of sample depth. An audio CD, which is 16-bit audio at 44.1KHz, would therefore have a dynamic range of around 96dB. This is one reason why professional audio is usually 24-bit; the dynamic range of 144dB is beyond the human limit and suitable for almost anything.

The chart at right gives examples of common decibel levels:

DCT/iDCT: Short for *Discrete Cosine Transform*, DCT is a technique for representing waveform data, such as audio waves, as a weighted sum of cosines. iDCT is *Inverse Discrete Cosine Transform*, which is basically just a means of taking the weighted sum of cosine data and turning it back into a waveform. DCT and iDCT itself does not lose any data in the process, but it is an important foundation of most lossy compression formats including most compressed audio, video, and the ubiquitous JPEG image format.

DRM: If you haven't heard of DRM by now, you haven't been reading the technology news for the past year or two. Short for Digital Rights Management, it's a blanket term for technologies designed to reduce or eliminate digital content piracy. When it comes to audio files, DRM involves the ability to do things like disable playback on foreign or unlicensed machines, limit the transfer of a file to some devices, or prevent it from being burned to multiple CDs. There are many different DRM technologies with a wide variety of capabilities,

Sound	Decibel level (dB)
Jumbo jet taking off 100' away	140
Jackhammer/Pain threshold	120
Nearby car horn	100
Noisy Traffic	80
Private office	40
Quiet living room	20
Quiet recording studio	10
Lowest perceptible to humans	0

and they're not always such a bad thing. It's possible for a format to have DRM capabilities that are not used, or for the content owners to set the DRM so "loose" that it's just like having an unprotected file— so long as you don't try to upload it to a thousand people on a file-sharing network. The MP3 file format contains no DRM capabilities, but almost all newer formats do.

ID3: The tag embedded within an MP3 file that includes fields for artist, album, title, track number, year, and a short comment. There is a slightly improved "v2" version of the ID3 tag that allows for longer comments and adds fields for composer, original artist, and a URL. Though ID3 specifically refers to MP3 files, there are similar tags embedded in most other digital media formats, many of which are more feature rich (some include room for lyrics, ratings, etc.). It's not uncommon to hear people refer to them all as simply "ID3 Tags."

The Major Audio Formats.

MP3: Contrary to what many people believe, this is not MPEG3 audio. It's actually MPEG, Layer 3. It was developed in the late 80s by the **Fraunhofer Institute** in conjunction with the **University of Erlangen**. Today, the patent rights belong to **Thomson** and **Fraunhofer IIS**, and are granted by Thomson. Many people think MP3 is "free," but a **license** is required to sell products that encode or decode MP3 as well as to broadcast commercial MP3 content. The standard was developed before content protection and online distribution of pirated music became an issue, and thus contains no DRM at all. This, along with the relative high speed of encoding and decoding, has made the format popular with end users, but not with record labels. None of the major for-pay online services use MP3 as their file format. You can read a lot more about MP3 at the Fraunhofer IIS page.

MP3 Pro: Thomson acquired this new format in 2001 from its Swedish partner company **Coding Technologies**, who developed it when researching a hearing device for the deaf. It claims to offer equal sound quality at half the bit rate of regular MP3. While this is certainly subjective, it does sound a lot better at very low bit rates (64kb/s and below). The chief advantage of MP3 Pro is that it is backwards and forward compatible with MP3— a basic MP3 player will play a MP3 Pro file, just without the improvements in sound quality. But MP3 Pro has no DRM capabilities either, so it shares in MP3's inability to gain acceptance by music studios.

WAV: The WAV standard was developed by **Microsoft** and **IBM** nearly two decades ago, and is the de-facto standard for basic Windows sounds. WAV files are usually uncompressed, but a compressed standard achieves a 4:1 compression ration through

an the lossy ADPCM (*Adaptive Differential Pulse Code Modulation*) scheme that drops each sample down from 16 bits to 4 bits. There are several other compressed WAV formats, such as GSM, ALAW, and ULAW, but these are even less popular than ADPCM.

AAC: Short for *Advanced Audio Coding*, AAC has been part of the MPEG-2 spec ever since the Motion Picture Experts Group declared it standard in April of 1997. It was developed by the Fraunhofer Institute in conjunction with companies like AT&T, Sony, and Dolby. Technically, the AAC format can support up to 48 full frequency sound channels, so 5.1 or 7.1 sound is entirely possible. It also supports sample rates up to 96KHz, twice the maximum afforded by MP3. Recently, MPEG-4 AAC added a couple of technologies to the spec that improve quality at extremely low bit rates (think cell phones). At higher bit rates, though, it's essentially the same as MPEG-2 AAC. This is the format used for songs downloaded in the popular iTunes Music Store, but AAC does not have any real DRM of its own, so Apple uses its own DRM "wrapper," called *FairPlay*, on iTunes songs.

WMA: Microsoft's *Windows Media Audio* format has undergone many major changes in the past few years, with drastic improvements in quality, efficiency, and features. Today's WMA9 technology includes four separate codecs:

- **Windows Media Audio 9**: Microsoft claims a 20% improvement in quality/bit rate over WMA8, but the big addition here is support for VBR encoding. Fortunately, you can decode WMA9 files with devices and software made to decode previous generations of WMA.
- **Windows Media Audio 9 Professional**: The Pro edition is similar to WMA9, but supports up to 24-bit/96KHz audio and sound formats up to 5.1 and even 7.1. One of its cool features is that the decoder will automatically adapt the audio material to whatever hardware you have. So if you try to play WMA9 Pro file that is 5.1 at 24-bit/96KHz on sound hardware that can only do stereo 16-bit/48KHz, it will fold the sound down to that spec.
- **Windows Media Audio 9 Lossless**: This is a VBR-only codec that produces absolutely perfect, mathematically lossless copies of an original audio file, including 24-bit/96KHz and 5.1 audio. The compression ratio isn't nearly as high as with lossy compression, averaging from around 2:1 to 4:1 (depending on the complexity of the source material.) This codec is

designed for professionals and audiophiles that want to archive perfect copies of their music.

- **Windows Media Audio 9 Voice**: This codec is optimized for extremely low bit rate files, like those that you would stream over a dial-up Internet connection or cell phone, or that you would use for real-time online voice chat.

Note that just because a portable music device or piece of software can play back "Windows Media Audio," that does not mean it can play the Professional, Lossless, or Voice formats. Those require their own decompressors. The WMA format has robust DRM and, coupled with Microsoft's influence and a reasonable royalty rate, has become quite popular among online music services. Napster, MusicMatch, BuyMusic.com, and Wal-Mart's online music store all use WMA.

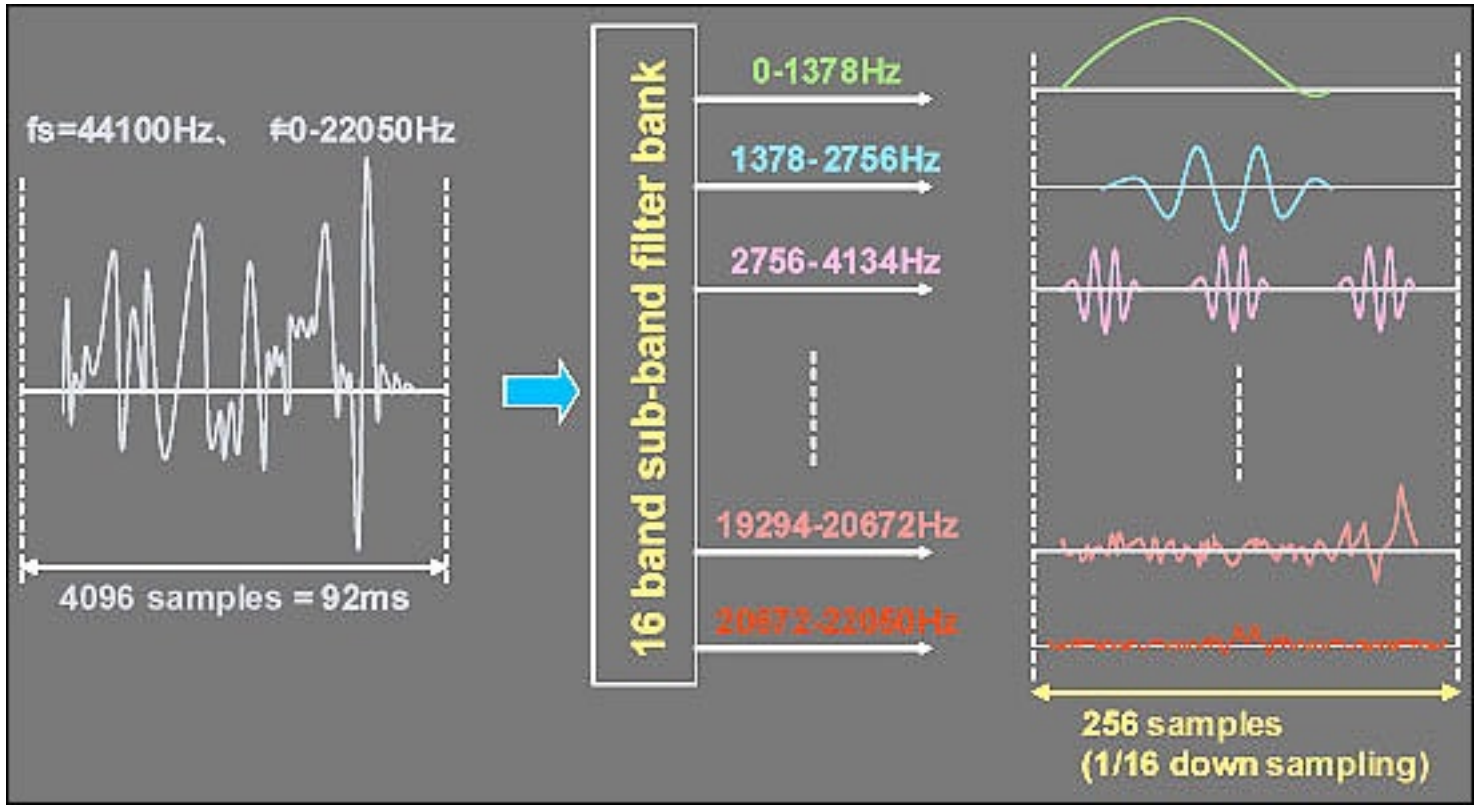
RealAudio: The RealAudio format from Real Networks started many years ago as a delivery mechanism for streaming audio over the net, primarily with dial-up internet connections. Times have changed, of course, and the latest technology is much more robust. At bit rates less than 128kb/s, RealAudio 10 uses its own proprietary compression technology. At higher bit rates, it uses MPEG-4 AAC. It's backwards compatible with RealAudio 8 players, too. The new Real 10 platform also incorporates RealAudio Lossless for true lossless compression and RealAudio Multichannel for up to 5.1 audio, though these formats require RealPlayer 10 or better for playback.

The Other Audio Formats.

Ogg Vorbis: Ogg Vorbis is similar to MP3 or AAC compression formats, but with one important difference. It is completely free, unpatented, and open-source. There are actually two terms here: Ogg is the file container that should one day contain both audio and video, while Vorbis is the actual audio compression designed to be contained within it. The .ogg container may embed other formats, though, like FLAC or Speex. This is important because the Vorbis compression scheme is optimized for music and general-purpose audio, not low-bit rate speech compression, and it has no lossless compression option. Vorbis supports 6-channel (5.1) audio, and is fairly well supported by software but almost unseen in the hardware player market. It's royalty-free nature has made it popular with some game developers, though. It is used several PC games including *Unreal Tournament 2003*, *Serious Sam: The Second Encounter*, and *Harry Potter and the Chamber of Secrets*, to name a few.

ATRAC: Sony's ATRAC (*Adaptive Transform Acoustic Coding*) format is most widely used in its

MiniDisc and solid-state Walkman **digital music players**. The original ATRAC format is arguably not quite as good as a well-encoded MP3 file, though it has gone through several revisions. Newer Sony hardware, like most **Clie PDAs**, use the superior (and incompatible) ATRAC3 format. The latest format, ATRAC3plus, promises twice the efficiency of ATRAC3, but is only just now seeing widespread support with the release of the Hi-MD MiniDisc players. ATRAC works by splitting the sound signal into separate frequency bands and compressing them separately.



FLAC: (*Free Lossless Audio Codec*) **FLAC** is like Vorbis in that it is totally free, unpatented, and open-source. As with other lossless compression formats, it produces rather large files, and in fact is not quite as efficient as some other lossless formats. For some users, being free and open-source outweigh whatever shortcomings the FLAC format may have.

Speex: Another open-source, patent-free audio compression format, **Speex** is targeted at compressing speech to very low bit rates— in the 2 to 44 kilobit per second range. It includes lots of good features, such as packet loss concealment and voice activity detection, and offers a VBR mode as well as the ability to change bit rate on the fly.

Shorten: Owned by Cambridge-based **SoftSound**, *Shorten* is a proprietary waveform coder that offers both lossless and lossy compression

modes. The lossy compression only offers compression ratios of 3:1 to 5:1, and is not very popular compared to more robust lossy compression schemes like MP3, AAC, or WMA. The lossless mode is a bit more popular among audio professionals and sound enthusiasts, with a typical compression ratio of about 2:1 for 16-bit audio.

Monkey's Audio: One of the more popular lossless audio compression formats is the *Monkey's Audio Compressor*, or MAC. We're not making this up. The FAQ makes mention of the name and file extension by saying, "*In hindsight, maybe it's a stupid name. Then again, maybe you just need to lighten up.*" The compressor can trade off encoding speed for compression ratio, though it's always in the neighborhood of 1.5:1 to 3:1, depending on the source material. The source code is available, but there is a license agreement which states you can't make commercial products with MAC unless you discuss terms with the developer first.

What to make of all this.

Believe it or not, this only scratches the surface of digital audio terminology and formats. There are dozens of other file formats and codecs out there, and certainly the lexicon of digital audio terminology would fill a dictionary. So what should you make of it all? Unfortunately, digital audio is more complicated than it has to be. Both the computer and CE industries would stand to gain from adopting more universal standards and working toward interoperability. Unfortunately, there are too many incompatible formats, too many exposed settings and important terms to learn, and too many companies trying to lock you into using their own tools. The only clear standard is the venerable MP3 file, which provides inferior quality compared to newer formats and lacks the DRM capabilities to make it viable for e-commerce. We expect something of a shakeout to happen over the next few years.

Other iPod Resources.

Extreme iPod.com

Apple's iPod site

iPod Hacks

iPoding

iPodlounge

iPod Infozone

MP3 at PC Mag.com

iPod Shopping