Chapter 1

What the Heck Is HDTV?

In This Chapter

- Understanding the acronyms
- Transmitting from ATSC to the world
- Going wide
- Avoiding the pitfalls

Since the transition to color TV in the 1950s and '60s, nothing — nothing!! — has had as much impact on the TV world as HDTV (high-definition TV) and digital TV. That's right. TV is going digital, following in the footsteps of, well, everything.

We're in the early days of this transition to a digital TV world (a lot of TV programming is still all-analog, for example), and this stage of the game can be confusing. In this chapter, we alleviate HDTV anxiety by telling you what you need to know about HDTV, ATSC, DTV, and a bunch of other acronyms and tech terms. We also tell you *why* you'd want to know these terms and concepts, how great HDTV is, and what an improvement it is over today's analog TV (as you can see when you tune in to HDTV). Finally, we guide you through the confusing back alleys of HDTV and digital TV, making sure you know what's HDTV and what's not.

Almost everyone involved with HDTV has noticed that consumer interest is incredibly high with all things HDTV! As a result, a lot of device makers and other manufacturers are trying to cash in on the action by saying their products are "HDTV" (when they are not) or talking about such things as "HDTV-compatible" when it might be meaningless (like on a surge protector/electrical plug strip). Be on the lookout for such interlopers and insist on true HDTV functionality. We help you in this chapter — read on!

Oh, Say, Can You ATSC?

A long time ago (over 50 years ago — longer than even Danny has been alive!), in a galaxy far, far . . . errr, actually right here in the United States . . . a group called the *NTSC* (National Television System Committee) put together a group of technical specifications and standards that define television as we know it today. Sure, some changes have been made in those 50 years (such as the addition of color), but today's analog TVs are built on this NTSC system.

Fifty years is a long time for any technology to dominate. Indeed, technologies and components used in television-transmission systems, cameras, recording systems, and display systems (the TVs themselves) have long been capable of doing something more.

In the 1980s, the *ATSC* (Advanced Television System Committee) was formed to move TV forward. Many years later (1996), the FCC (Federal Communications Commission — the folks who set standards for TV broadcasts, regulate phone companies, and fine Howard Stern) adopted the ATSC's recommendations for a digital-television system. ATSC standards use newer-than-1953 technology to give you TV like you've never had before:

- Widescreen images like those in the movies
- Greater detail — up to six times more detail
- Sharper images
- Smoother, more film-like images with no video flicker
- All digital, with none of the *ghost* images — where you see a translucent version of the image on your screen, slightly offset — and other image problems found in analog TV

Please note that ATSC is not the only game in town when it comes to digital TV and HDTV. In most European countries and in many other parts of the world, the DVB (Digital Video Broadcasting) standard applies. (Terrestrial, cable, and satellite variants exist, noted by a -t, -c, or -s appended to the DVB.) In Japan and a few other countries, there's a system known as ISDB (Integrated Service Digital Broadcasting). These systems all use different mechanisms to *encode* (or digitize and compress) video signals for transport over the airwaves, over a cable, or via satellite. The impact here is that the device you use to tune in your HDTV signals differs depending upon your country.

Regardless of which system is in use where you live, the important thing to you as a viewer is the picture itself, and that's where HDTV is truly a universal phenomenon. HDTV pictures contain two to six times more picture detail than older analog *standard-definition* systems (again, this is true regardless of which country you're dealing with). This extra detail lets you display your TV content on a bigger screen and still see a great picture. You also see more vivid colors, a wider screen presentation, and the increased picture quality enabled by digital transmission. No more ghosts and snowed-out pictures — digital is usually either a great picture (most of the time) or essentially no picture at all (on those rare occasions when you don't have a good enough signal).

Throughout this book, we focus on the U.S.-based ATSC system, but our real focus is on the HDTV formats we're about to discuss, such as 720p and 1080i, which apply no matter where you live and no matter how your TV is delivered to you.

Powerful Performance

HDTV is all about giving you a bigger and better picture, better audio, and generally making your TV-watching experience more like a movie-watching experience. (Digital TV, or DTV, in general also does the same thing, but some digital TV variants are *not* high definition, and we discuss them in the following sections.) In fact, at its best, HDTV is so realistic that it's often described as "looking through a window" — as if you're really there, not just watching a program.

Video standards

In this section, we discuss the characteristics of the HDTV programming itself (be it broadcast over the airwaves, over cable, via satellite, or saved on a hard drive or optical disc). There's a related category of the *display* characteristics for HDTV — meaning what your HDTV can actually show you on the screen. Many HDTVs can accept different types of HDTV signals and then transform them into the resolution, aspect ratio, and other such formats that work best on the HDTV display itself. We talk in detail about this in Chapter 22.

You need to understand four essential concepts when comparing different video standards:

- **Resolution:** The number of individual picture elements that make up a TV image. The higher the resolution, the more detailed the image and the sharper the image.

  Resolution is defined by one of two factors:

  - *Lines:* The number of left-to-right lines — counted vertically, like a stack of pancakes — the TV can display. CRT-based TVs (tube TVs) are rated this way.
  - *Pixels:* The number of pixels across the screen times the number of pixels up and down. Fixed-pixel displays (plasmas, LCDs, DLPs, and the like) are rated this way.

- **Scan type** comes in two forms:

  - *Interlaced scan:* These TV images are created by lighting up every other row of horizontal lines on the screen in one instant and then going back through and lighting up the remainder of the lines in the next instant. It happens so fast that your eye can't really tell it's happening. In an interlaced system, these groups of lines (each consisting of half of the picture) are known as *fields.*
  - *Progressive scan:* These systems light all the horizontal lines in the same instant, which can make the image seem "smoother" and more like film (or real life). In progressive scan, this grouping of all the lines is called a *frame.* Two interlaced *fields* combined together equal one full *frame.*

- **Scan rate** is the measure of how often a picture is redrawn on the screen, measured in terms of the number of fields (for interlaced scan) or full frames (for progressive scan) that are drawn on the screen per second. In the United States, this is typically either 30 or 60 times per second (often called *hertz*). In European markets, it's often 50 hertz.

  Movies themselves are usually filmed at 24 frames per second, which then must be converted to 50 or 60 during the process of turning film into video.

- **Aspect ratio** (the shape of your TV picture):

  - Traditional TVs have a 4:3 *aspect ratio.* This means that for every 4 units of measure across the screen, you have 3 units of screen height. For example, if the screen is 12 inches wide, it's 9 inches high.
  - HDTVs have a 16:9 aspect ratio — which makes the screen relatively much wider for the same height, compared to a 4:3 TV. Most movies are widescreen (16:9, or even wider), so HDTVs can display most movies without the annoying *letterbox* black bars on the top and bottom of the screen. Figure 1-1 compares aspect ratios.

Figure 1-1: Going widescreen with a 16:9 aspect ratio.

Don't get bogged down in up-front technical explanations of these concepts now. If you want to know all there is to know about such TV concepts as resolution, pixels, scan rates, and interlacing, run (don't walk) to Chapter 21 right now. We'll still be here when you come back.

HDTV standards

There isn't a single HDTV standard out there. Instead, digital TV systems contain dozens of different TV standards (with different resolutions, aspect ratios, and scan types and rates). Some of these standards are truly HDTV; most are not. In the real world, you deal with three primary formats that are considered true HDTV:

- **720p:** This provides 720 lines of resolution with progressive scan (hence the *p*). By comparison, NTSC has less than 480 lines of resolution. In pixel terms, it has a resolution of 1,280 across by 720 vertically. 720p uses a 16:9 widescreen aspect ratio. You can find 720p in HDTV broadcasts and also in recorded HDTV content like HD DVD and Blu-ray discs.
- **1080i:** This variant (the highest resolution within the ATSC standard) uses interlaced scanning but provides 1,080 lines of resolution. In pixel terms, 1080i fills your screen with 1,920 pixels across by 1,080 vertically. 1080i is also widescreen, with a 16:9 aspect ratio.
- **1080p:** The big dog in the HDTV world is 1080p, which provides the same number of pixels or lines as 1080i but does it in a progressive scan fashion, so all 1,920 x 1,080 of those picture elements are redrawn each time your screen is refreshed, rather than only half per refresh. Today, 1080p is found only in recorded HDTV formats such as Blu-ray and HD DVD.

If you see 720i listed as an option, don't believe it. Either it's a typo for 720p, or someone is trying to fool you. No broadcast standard permits 720 *interlaced* lines in a video frame at any frame rate.

True HDTV performance requires at least 720p performance. If a TV program, movie, or other content isn't at least 720p (either 720p or 1080i), it is *not* HDTV. If a TV can't display at least 720 lines of resolution, it is *not* HDTV-capable.

If a salesperson tries to tell you that an inexpensive plasma set, regular DVD, regular digital cable, or regular satellite TV is HDTV just because it's *digital,* it's not so.

Compatible DTV standards

720p, 1080i, and 1080p are the three main HDTV standards, but you can also find a lot of digital TV material that is broadcast at lower resolutions that don't quite make the grade as HDTV. You can still watch this programming on your HDTV. In fact, most HDTVs make this programming look better than it does on a regular TV, but remember: This stuff *is not* really HDTV:

- **480p (EDTV):** This *enhanced-definition* TV standard provides higher-than-NTSC resolution with progressive scan (NTSC is interlaced). EDTV can be (and often is) 16:9 widescreen, but it isn't required to be widescreen.
- **480i (SDTV):** This is interlaced, non-widescreen (4:3), standard-definition TV, equivalent to NTSC analog broadcasts.

Remember these different terms — HDTV, EDTV, and SDTV — when shopping. They often are in the product descriptions; you need to know exactly what you're buying.

Audio standards

The ATSC standard includes big improvements in the audio part of television — what you hear as part of any movie, video, or TV show. That's because ATSC includes Dolby Digital surround-sound capability in the overall standard for digital TV.

Dolby Digital (which we discuss in greater detail in Chapter 18) doesn't *always* mean surround sound. Some Dolby Digital soundtracks are stereo (two channels) or even mono (one channel). ATSC supports surround sound if a program's producer and broadcaster want to include it.

The NTSC broadcast standard supports only stereo audio (two channels) and not surround sound. Luckily, most DVDs (and some satellite and digital cable TV channels) include Dolby Digital soundtracks that can provide true surround sound. You can also use a home-theater receiver that supports systems like Dolby Pro Logic II (see Chapter 18) to create surround sound from these sources.

Dolby Digital and surround sound in general provide an audio soundtrack for TV shows and movies that — wait for it! — *surrounds* you and provides audio that matches the action on-screen. For example, surround sound might use speakers mounted in the rear of the room to reproduce ambient noises of the setting around the action, or it might give a 3D sense of space to those creepy footfalls of the bad guy sneaking up behind the protagonist.

Dolby Digital provides six channels (confusingly called *5.1*) of audio. Here's what they do:

- A center channel carries the dialogue being spoken by characters on your HDTV screen.
- Two main front channels handle left and right sound cues (and the soundtrack music) in stereo.
- Two surround channels (mounted in the rear of the room) provide a sense of 3D space.
- A Low-Frequency Effects (LFE) channel conveys deep bass sounds (such as exhausts rumbling and bombs exploding). The LFE channel is the ".1" in the 5.1 naming scheme for Dolby Digital. This channel gets a fraction rather than a whole number because it contains only low-frequency sounds, not sounds for the full range of human hearing.

Figure 1-2 shows a typical Dolby Digital surround-sound layout.

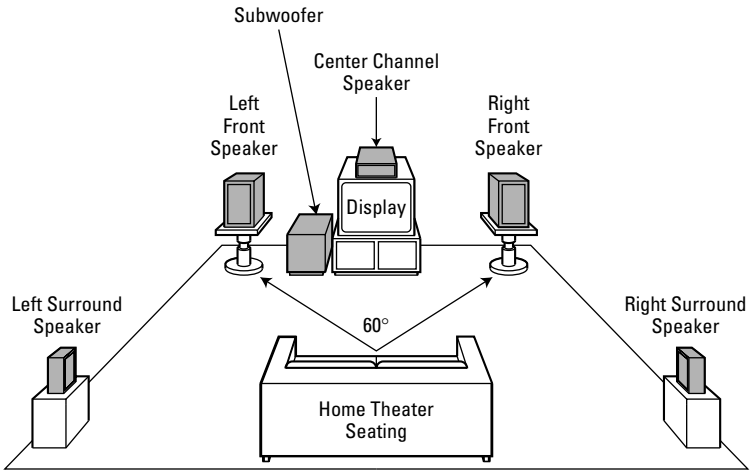

Figure 1-2: Doing the surround-sound thing.

We talk about surround sound in much more detail — including details on what sort of equipment you need to hear it properly in your HDTV viewing room — in Chapter 19.

Some new "better than Dolby Digital" standards are being included in Blu-ray or HD DVD disc players. These provide higher-quality audio and more surround channels. You can read about these new standards in Chapter 18 as well.

Perplexing Pitfalls

HDTV isn't the easiest thing in the world to get figured out — we've been dealing with it for years and still run into advertising and marketing mumbo-jumbo that make us say, "Huh?" The whole purpose of this book is to help you wade through the marketing manure and to get you up to speed on HDTV. So without further ado, here's a list of HDTV danger zones:

- **Digital confusion:** The biggest (and most prevalent) myth we see in the HDTV world is the notion that any kind of digital TV signal (such as digital cable, digital satellite, or DVD) is HDTV. This simply isn't true. A TV signal must be 720p resolution or higher to be considered high definition. We've seen too many people buy an HDTV, hook it up to their existing cable or satellite box, and then wonder why the picture isn't all that they'd imagined it would be — simply because they'd missed the step of activating an HDTV service to make it all work properly. In Part II, we go into detail about how to get HDTV broadcasts into your HDTV.

  

  Sometimes it's as easy as just changing the channel. Pat doesn't want to do this, but he's going to use the example of his dad and brother here. They had set up a new HDTV in Pat's dad's home and were watching a football game in what they thought was HDTV — and complaining how awful the picture was. It took about two seconds to change from the standard-definition broadcast on channel 4 to the high-definition one on channel 704. Jaws dropped, and all was well in the HDTV world again.

- **Input versus display resolutions:** When you're shopping for an HDTV, you can often see marketing and sales literature that includes a huge listing of resolutions that an HDTV can *accept.* The important thing to remember here is the difference between the resolution of the inputs (the source signals going into the HDTV) and the actual resolution of the picture on the screen. For example, an HDTV might say 480i/480p/720p/1080i on the box but have a display resolution of something like 1,280 x 720. What all these numbers mean is that you can tune into a program at any of these resolutions, and the TV converts the picture to the TV's display resolution. There's nothing wrong with this. (It's the standard behavior of just about

every HDTV on the market, including all plasma, LCD, LCoS, and DLP TVs.) However, it leads to confusion when a consumer is buying an HDTV that's capable of 720p resolution but is convinced that it can display the full resolution of 1080i due to the confusing labeling on the box. One place to pay close attention to this phenomenon is in the case of EDTVs, discussed in the next bullet.

- **EDTV confusion:** EDTVs are TVs (typically 42 inches and under, plasma, flat-panel models) that cost a lot and can display progressive-scan images. However, they don't meet the minimum requirement of 720p, so they don't display true HDTV signals. Nothing is wrong with EDTVs; just don't be fooled into thinking you're getting an HDTV when you're not. We see a lot fewer EDTVs on the market today, but do beware: We can't think of a reason to buy an EDTV when HDTVs cost the same *or less* in most instances. Although some folks are of the opinion that given a certain viewing distance and screen size you really can't tell the difference, we'd still rather go with the HDTV variant.
- **Image scaling:** We're starting to see some new marketing being applied to an old concept — *image scalers* that can convert video signals from one resolution to another.

  You most often see image scaling in the case of up-scaling DVD players (see Chapter 11), which scale a standard 480p DVD image to 720p, 1080i, or even 1080p. This can often generate a better picture on your HDTV's screen than a plain old DVD player, but it's not the same as true HDTV (which is now available with Blu-ray and HD DVD discs). Some manufacturers are even marketing these upscaling DVD players as "high-definition" players, which we find to be almost deceptive advertising.
- **The DTV tuner:** As HDTV (and DTV in general) becomes more prevalent, *DTV tuners* will become common. These tuners (discussed in Chapter 7) let older TVs "watch" DTV broadcasts. HDTV tuners do *not* turn older analog TVs into HDTVs. They just convert DTV signals to NTSC for display on an analog TV.