Tuning Tips for Using LP-Pan and Associated Software on PC's using the Windows Vista Platform

Preface

These notes document my efforts to utilize LP-Pan and some of the associated software with my Lenovo T61p laptop running the Windows Vista 64 Business operating system. I quickly found out that running audio or video streaming software can be very problematic on the Vista platform with many glitches and audio dropouts which made the audio streaming capabilities of Power SDR useless.

The bad news is that trying to run these applications on a stock loaded Vista machine may yield horrible results as noted above. But the good news is that with a few minor tweaks, very stable results can be accomplished. The audio glitches and dropouts are caused by latency problems that can be native to the PC and Vista operating environment. Researching audio latency problems on Vista platforms yields many results. I found some of the most useful information from websites that market professional music production software. This make a lot of sense in that they would need to know how to tweak Vista in order to effectively market their software to those end users.

The following sections will document my experimentation starting with a Quick Start section that will detail the steps I took to tune my system for smooth operation of the LP-Pan environment. This will give you a quick start to try things out to see if they will make a difference on your system. The sections following this will contain more detailed information of the tuning steps as well as links to the web pages I used to obtain most of the information.

Although this information pertains to my limited exposure to the Vista operating system and specifically to my hardware setup, I believe that most of the tweaks discussed here will pertain to many different hardware and software setups that involve a PC on the Vista platform.

All of the usual disclaimers apply: this information is for discussion purposes only and I can not be held responsible for any ill side effects or problems associated with trying anything discussed here on your system. Users beware and try at your own risk.

Quick Start

1. Before starting anything you need to get a baseline for what, if any, latency issues your particular system may have. I used the highly documented **DPC Latency Checker**: http://www.thesycon.de/eng/free_download.shtml . Follow the directions for installation and use it to see if any latency problems exist. I would start with looking at your system with nothing running but the desktop and then take a look at what it looks like with the entire LP-Pan software environment loaded and streaming audio just to get a feel for what your system is going to look like.

2. **Update Vista to Service Pack 1**. It contains many updates including fixes for solving latency issues and rewritten, better behaved hardware drivers.

3. **Update your hardware drivers**. Many early drivers written for Vista have latency problems because of the model used to develop them. Most vendors are updating their drivers now to be better behaved. More will be released in the near future.

4. **Update Vista to the latest Windows Indexing Search Engine**. It is now version 4.0 and has been optimized to be a little kinder to your PC resources while operating in the background.

5. **Adjust Power Management**. Go to the **Control Panel->System and Maintenance->Performance Information-> Adjust Power Settings** and select **High Performance**. This ensures the CPU is running at full speed at all times preventing some audio latency issues.

6. **Adjust Visual Effects**. Go to **Control Panel->System and Maintenance->Performance Information and Tools->Adjust Visual Effects** dialog and select **Adjust for Best Performance**. This will basically eliminate the Aero user interface which on many systems is a CPU hog and leads to many audio drop outs. It looks pretty ugly, but certainly usable and makes a big difference in the audio latency issue.

7. **Adjust Processor Scheduling**. Then go to the **Advance tab** on the same dialog and select **Background Services** in the **Processor Scheduling** area. This will help divert CPU processing to the ASIO drivers if used for your particular sound card.

Detail of these steps will be explained in the following sections.

After the initial downloading and installation of updated drivers and Vista modules is completed, the other Control Panel tweaks can be performed with a few mouse clicks. Currently, I perform the Control Panel tweaks only when I need to use my system with LP-Pan and switch it back to "normal" when used outside of the LP-Pan environment. My reason for this is that my system is a laptop, and I need to:

- Have the power management capabilities when using the battery.
- Allow the CPU to clock down and run cooler.

* Enjoy a nicer user interface when not streaming audio.

Your personal preferences may differ as well as the type of PC and hardware you are running. But switching back and forth between the Visual Effects and Power Setting is really only a matter of a few seconds, and I have found it to be no problem or irritation at all (especially in order to get nice clean audio from PowerSDR).

Analysis Detail

My Environment

The following documents my hardware and software environment at the time of this writing:

* LP-Pan serial #175
* Elecraft K3 #338
    * Firmware: MCU v2.23 – DSP v1.88
* Creative Professional E-MU 0202 USB Sound Interface
* Lenovo Thinkpad T61p
    * 2.4Ghz Intel Duo Core CPU
    * 4 GB Ram
    * 160 GB HD
* Windows Vista 64 Business Edition, SP1
* LP-Bridge v0.9.78
* PowerSDR v0.92
* Ham Radio Deluxe v4.0

Research

Google searching for latency problems with Vista will produce pages and pages of results. This has been a known problem since the release of Vista and is slowly being addressed. The latency issues can be split into a hardware and software category.

Apparently, the hardware driver development model has changed in Vista. Not only do hardware vendors need to have their drivers "signed", but the new model requires developing the driver in a different method. This method helps ensure that the different drivers coexist and behave properly with each other and the operating system. In many of the early releases, the older models were used and if a particular driver grabbed hold of some resources and processing time and did not release them in a timely manner, this would lead to latency problems.

On the software side, Vista itself has some bottlenecks that need to be addressed. The Aero user interface looks nice and has many nice features, but can at times be a resource hog and again lead to latency issues.

Here are some links to some of the most useful information I found regarding audio latencies in Window Vista:

- http://www.focusrite.com/answerbase/article.php?id=288
- http://createdigitalmusic.com/2007/04/05/how-to-kill-windows-vista-bottlenecks-pt-i-aero-and-display-issues/
- http://createdigitalmusic.com/2007/04/05/how-to-kill-windows-vista-bottlenecks-pt-ii-stop-the-disk-churning/
- http://createdigitalmusic.com/2008/07/01/adieu-xp-how-vista-sp1-is-doing-and-why-this-os-generation-has-been-so-tough/

DPC Latency Checker

First and foremost, you need a baseline to measure problems, if any, with latency on your system. A free utility exists, and is widely used by many to do just that: http://www.thesycon.de/eng/free_download.shtml. Review the directions that come with the utility for how to install and operate. I would, before making any changes to your environment, run the utility with only the basic UI (no other programs running) and then with what you would normally run with your LP-Pan environment and take some screen dumps of the DPC Latency Checker for later comparison.

Update Windows, Drivers and BIOS

Next, make sure you are running Service Pack 1 for Vista. There have been dramatic changes to improve audio and video streaming latency issues as well as many updated drivers that "play well" with others and Vista. I would also recommend updating to Vista's latest Indexing Search Engine v4.0: http://www.microsoft.com/downloads/details.aspx?FamilyId=BC28ED7F-C51B-49CD-B505-95B91B453284&displaylang=en&displaylang=en

There is also a free Vista Gadget for monitoring the Indexing Engine: http://brandontools.com/content/IndexerStatusGadget.aspx. This may help you see peaked latency issues when indexing is being performed in the background.

After updating Vista, make sure to download all of the latest drivers and BIOS for your system. This alone made a dramatic difference in my system. Before updating my drivers, I would see latency problems well into the red while just idling with the normal UI and nothing else loaded. After updating my drivers and bios, I would then only see peaks of latency problems every few seconds or so.

Below is a screen shot of what DPC Latency Checker typically looked like before updating my Vista operating system and hardware drivers. This made my system totally unusable for the audio streaming needed by PowerSDR.

High latency problems before updating Vista and hardware drivers.

Below is another screen shot shortly after updating Vista and my device drivers.

Better picture after updating Vista and hardware drivers, but not quite there yet.

As you can see, I had spikes every ten seconds or so, and depending on what was running in the background, they might occur more frequently or in clusters. This certainly was an improved situation, but those spikes every ten seconds would be enough to drop out the audio stream in PowerSDR. And moving anything on the screen or starting up an application would cause a 60,000us spike. Further refinement would be needed.

Update Windows Search Engine Indexing Software

In the second tune up article referenced above, it was suggested to turn off Windows Search Engine Indexer and the System Restore Points. These services would appear to come on at random and take up considerable resources causing audio latency problems in the event they executed while trying to stream audio. Both of these tune up articles were written before Vista SP1, so I decided to try upgrading to the newer Windows Search Engine v4.0. This version is considerably better at resource management and seems to coexist better in the system. At this point, I have also not turned off System Restore Points. I do have some system backup software that came with my laptop and if I can securely use it instead of the System Restore Points system, I may opt to do that.

Adjust Power Management Settings

This was a big improvement for my system because the power management settings were set very conservatively to save power and charge the battery in a mobile environment. In these power conservation modes, the CPU is clocked down at intervals and certain hardware devices are put to sleep. It takes time for

the CPU to come up to speed and wake up hardware and this is what would cause the latency spikes every ten seconds or so, on my system.

By setting the power management scheme to High Performance on my system, I was able to eliminate these spikes. This mode runs the CPU at high speed all the time and most likely the cooling fans will run at a higher rate to keep up with the generated heat.

Since the adjustment is only a few mouse clicks away, I will only run in the high performance mode when I need PowerSDR's audio streaming capabilities and set it back to normal for everything else.

Go to the **Control Panel->System and Maintenance->Performance Information-> Adjust Power Settings** and select **High Performance**.

Setting the power management plan to high performance.

Adjust Visual Effects

When doing anything with the user interface while running the LP-Pan environment, I would still get dropouts. Spikes over 60,000us would appear when doing tasks like bringing up FireFox or invoking the Start Menu. Also, dragging the PowerSDR panadapter screen to tune in the 192Khz mode would cause dropouts.

Setting the Visual Effects for Best Performance basically eliminates the Aero user interface of Vista and lessens the load on the CPU and GPU when performing graphics operations. The look is very basic and not as nice as the full Aero interface, but the performance is much better and prevents the dropouts I experienced when doing anything with the UI.

Go to **Control Panel->System and Maintenance->Performance Information and Tools->Adjust Visual Effects** dialog and select **Adjust for Best Performance**.

Setting the visual effects for best performance.

Adjust Processor Scheduling

Adjusting the processor scheduling for Background Services will divert more processing power to the ASIO drivers used in some sound cards. In my case, the E-MU 0202 does not have drivers recognized by the PowerSDR software, so the ASIO drivers must be used.

Go to the **Advance tab** on the same dialog and select **Background Services** in the **Processor Scheduling** area.

Setting the processor scheduling for background services.

The End Result

After making the prescribed adjustments, the latencies on my system dropped dramatically. Here are the before and after screen shots of latency monitoring with just the basic UI displayed. No other applications are running at this time. (Note the difference in visual effects of the two windows).

After some very non-scientific tests, I am able to perform most normal operations on my system without audio dropouts. I have LP-Bridge, PowerSDR and HRD running and interacting with each other. Dragging the panadapter screen and tuning quickly is very smooth even at 192Khz bandwidth. Invoking QRZ.COM in one of the browser windows in HRD works smoothly as well.

Running other applications like FireFox and Outlook seem to work fine. Once in awhile (and through a number of linked combinations) Outlook will produce a spike around 4000us that may sometimes result in a drop out. The most common combination seems to be in bringing Outlook to focus while it is checking for new mail and receiving some. More research here may be needed.

The following is a screen shot of latencies with the whole LP-Pan suite of software applications running with PowerSDR streaming audio.

Latency screen shot with all modifications documented here with LP-Bridge, PowerSDR streaming audio and HRD running.

Other Possibilities

One of the other suggested areas to check are the Startup programs invoked when Vista starts as well as taking a look at Task Manager to list the processes running to see if any can be eliminated. This can be somewhat daunting in that it is not always easy to know what a particular application or process does, or if it is even needed. Some trial and error tweaking may be needed here if you believe one or more of these processes are causing a problem.

Another noted point should be that Vista (and just about any other operating system) has many services that run in the background and may grab resources when needed without notice. If you are using the DPC Latency Checker, they may appear as gradual increases for a small amount of time and then go away. Or, they may appear as a momentary large spike and retreat just as quickly.

Vista does have some nice reporting tools for tracking performance issues and Microsoft also has a very detailed analytical tool for monitoring resources. These again, can be somewhat daunting for the casual user and sometimes provide large amounts of data.

Another suggestion outlined in one of the documents listed above, is that PCI hardware latency values could be adjusted to provide more balanced bus latency between hardware devices. One application noted to allow these adjustments can be used on some systems, but needs to install drivers to perform these actions. While it might be advantageous to make adjustments in this area, I for one could not install the drivers because Vista 64 will not allow unsigned drivers to be installed. If you are using the 32 bit version of Vista, you may still be able to install the application. But I would only attempt this if the other adjustments outlined here were unsuccessful in obtaining consistent audio streaming.

Summary

Making the adjustments outlined in this document had a profound effect on how my system performed audio streaming operations. The future updates and service packs for Vista are supposed to continue to improve the performance issues. Device driver writers are also catching up with the new Vista model and writing drivers that conform and perform well (acting like good neighbors).

Even if you can get your Vista PC to work as well as I have, I would still continue to find and upgrade device drivers when available as well as Vista service packs.

Disclaimer

I am, by far, no expert in the technical areas discussed in this document. Although I worked in the computer IT field for 16 years, I've spent the last 10 years in the fire service with a few PIC microcontroller programming jobs on the side. So, any low level technical expertise in the Windows operating system has left my brain long ago. My current experience is that of an end user.

Again, this is a very narrowly focused experiment in adjustments for my system for the sole purpose to reduce, if not eliminate, latency problems associated with streaming audio. Some of the things outlined here may not have the same positive outcome on other systems. Other tweaks may be needed on systems with different hardware configurations or misbehaved device drivers. In other words, your mileage may vary.

Again, all of the usual disclaimers apply: this information is for discussion purposes only and I can not be held responsible for any ill side effects or problems associated with trying anything discussed here on your system. Users beware and try at your own risk.

73,

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