OPTIMAL PARTS CONFIGURATION, CONSTRUCTION AND SETUP OF AN

ECONOMICAL DIGITAL HOME MEDIA CENTER

by

Jon J. Provancher

A PROJECT

submitted to

Oregon State University

University Honors College

in partial fulfillment of
the requirements for the
degree of

Honors Baccalaureate of Science in Electrical Engineering (Honors Scholar)

Presented March 3, 2009
Commencement March 2009

AN ABSTRACT OF THE THESIS OF

Jon J. Provancher for the degree of Honors Baccalaureate of Science in Electrical Engineering presented on March 3, 2009. Title: Optimal Parts Configuration, Construction and Setup of an Economical Digital Home Media Center.

Abstract Approved: _____

                        Dr. Ben Lee

Designing and building a home Media Center can be a daunting task given the multitude of available options and configurations.   The goal of this project is to build a home Media Center, and in the process, create a guide that a less technically knowledgeable person could use to build their own system.   Initial hardware research provided the foundation for a design and explained the relevance of the different components. Using the concepts derived from the research, a successful Media Center was built that offered a medium for software testing.   Debugging the various software issues provided an opportunity to record the solutions to common problems that can occur during the configuration of a Media Center.   By documenting the entire build and configuration process, an easy to understand guide was produced that provides the necessary knowledge for anyone to construct their own home Media Center.

OPTIMAL PARTS CONFIGURATION, CONSTRUCTION AND SETUP OF AN
ECONOMICAL DIGITAL HOME MEDIA CENTER

by

Jon J. Provancher

A PROJECT

submitted to

Oregon State University

University Honors College

in partial fulfillment of
the requirements for the
degree of

Honors Baccalaureate of Science in Electrical Engineering (Honors Scholar)

Presented March 3, 2009
Commencement March 2009

Honors Baccalaureate of Science in Electrical Engineering project of Jon J. Provancher presented on March 3, 2009

APPROVED

_____

Mentor, representing Electrical Engineering and Computer Science
– Dr. Ben Lee

_____

Committee Member, representing Electrical Engineering and Computer Science
– Instructor Christine Wallace

_____

Committee Member, representing Chemical, Biological and Environmental Engineering
– Dr. David Hackleman

_____

Head, School of Electrical Engineering and Computer Science
– Dr. Karti Mayaram

_____

Dean, University Honors College
– Dr. Daniel J. Arp

I understand that my project will become part of the permanent collection of Oregon State University, University Honors College. My signature below authorizes release of my project to any reader upon request.

_____
Jon Provancher, Author

ACKNOWLEDGEMENT

This project could not have been completed without the help of many people. First, thanks to Dr. Lee for his willingness to serve as my supervisor for this project both in concept and in practice. If it were not for his class I would not have had the inspiration to even start this project.

Thanks to Instructor Wallace and Dr. Hackleman for acting as advisers for this project and providing additional support throughout the design process. Though I may not have fully utilized their resources, the knowledge that I had help available at any time was very important.

Thanks to my parents for agreeing to fund the project so that I could focus my time on research and design. Additionally, their support in all design decisions was invaluable and provided motivation to finish the project.

Thanks to the Honors College for providing the opportunity to work on this project. If it were not for thesis program I might have let this project pass me by.

TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

The goal of this document is to provide a guide for building a Media Center that can be understood by a person of limited technical knowledge. This is necessary because the information available on this topic is overwhelming even to a person with a fairly high level of technical knowledge. This document is broken down into sub-sections that, when combined, encompass the Media Center build process from start to finish. This document will provide background knowledge on the required hardware, including recommendations about product selection. This document will also provide a step-by-step walk-through of the physical build process as well as the Windows install process that will allow the reader to transform various hardware components into a working Media Center. This document will not include all possible builds or the install process for a Linux based Media Center.

HARDWARE BACKGROUND

This section will discuss the parts that are required to build a Media Center. Included with each part will be a description of the part's function, whether spending more money on this part will result in a significant increase in performance, and my recommendations for selecting this part.

Case

Function

    The case is the least technical component of the build. Its purpose is to act as the storage center. This can range from a simple box to a very neat looking enclosure with an LCD display. A nicer Media Center case will have more features that need to be connected than a basic case, however, none of this is overly complicated. Since this is going to be the storage place for all of the electrical parts it is necessary to select a proper case.

Increased Investment

    Increased investment in a case provides no performance advantage and comes down to personal preference and use expectations. If the Media Center is going to be placed somewhere visible, it may be worth upgrading to a sleek looking case with an LCD display. If it will be placed inside a component cabinet out of sight, the fancier cases provide less benefit.

Recommendations

    For your first build it is probably worth spending some extra money to get a higher quality case because they tend to be sturdier and often provide little extras that make the build easier. A larger case will also provide an easier build because there will be more room to work in, but this will also result in more space required for storage.

Motherboard

Function

The motherboard provides the electrical base for all other electrical components. It functions as the communication interface for all plug-in cards, disk drives and any other input devices. It is the control system for USB, Firewire, SATA, parallel cables and allows for communication between devices. Ultimately, the motherboard allows the different parts of the Media Center to talk to one another and pass information back and forth.

Increased Investment

Even today's basic motherboards are more than enough to do everything that is required by a Media Center system. Increased investment in the motherboard may provide some additional features, though most of them are unnecessary for a Media Center. A reasonable, middle of the line motherboard will provide an adequate sound card and all of the expansion ports required for this build.

Recommendations

The motherboard must be able to house several plug-in devices. These plug-in devices include a video card, tuner card (at least one) and wireless card (optional). This means that at a minimum there must be two plug in slots, and as many as four or five might be necessary. Motherboard selection will depend on how many external cards will need to be connected. Also, make sure that the on-board sound card provides the output capabilities that you are looking for (optical, coaxial, etc).

One of the big worries when selecting a motherboard is to ensure that it is compatible with the processor selection. To make things simple and to ensure processor compatibility, it is possible to select a motherboard and processor bundle. These can be found on sale frequently at any electronics store or online. Avoid any combination with a Micro ATX motherboard because this will most likely not have enough external plug-in slots. If you would rather select the parts individually, make sure you select the correct architecture (either Intel or AMD) and look for the "Socket Type" of the processor and a motherboard that supports that Socket Type.

Processor (CPU)

Function

The processor functions as the brain or control circuitry for the Media Center. Using the communication structure on the motherboard, it coordinates processes and controls all actions. The other components on the motherboard route through the processor in order to get work done, meaning that other components must ask the processor for a portion of its time to complete the work they need.

Increased Investment

Increased investment in a processor will ultimately lead to a faster processor. Processor speed is measured in Hertz which is the number of cycles per second that the processor can complete. This means that a faster processor can execute more instructions per second, or is able to service more of the components on the motherboard more quickly. However, like the motherboard, most of today's processors will be more than

enough for the Media Center purpose because much of the work will be done in hardware on the graphics card and tuner card.

<u>Recommendations</u>

One of the most difficult parts of processor selection is making sure that it is compatible with the motherboard you selected. As was mentioned in the motherboard section, it is easiest if you choose a motherboard and processor (CPU) bundle. Avoid any combination with a Micro ATX motherboard because this will most likely not have enough external plug-in slots. If you are selecting the parts individually, I recommend selecting the processor first and then finding a motherboard that matches the Socket Type. There is no need to spend over $200 for the motherboard and CPU combined.

RAM (Memory)

<u>Function</u>

RAM functions as the active memory for the Media Center. It is where the processor stores all of the information currently in use. The communication between the RAM and the processor is very quick, so having enough memory for the processor is important to prevent bogging down the system.

<u>Increased Investment</u>

Increased investment in RAM will provide a larger working memory or a higher performance memory. You can avoid purchasing high performance (gaming) RAM because the stress level on these components will be minimal. There is also no reason to purchase DDR3 RAM because it is significantly more expensive than DDR2 and the

performance advantage is not noticeable in a Media Center. By increasing the amount of memory available to the Media Center, it will increase the overall speed of transactions in the Media Center.

Recommendations

I recommend getting at least 2 GB of any basic DDR2 RAM. This will provide enough RAM for all Media Center purposes, however, since RAM is so cheap it may be worth upgrading to 4GB of memory to prevent the need for future upgrades.

Hard Drive

Function

The hard drive functions as the storage device for all of the saved and recorded media. The functionality of these drives is very similar to the drives on a regular PC, but they will be managed by the Media Center operating system.

Increased Investment

Investing more on hard drives is one place where each increment (up to a certain point) provides increased functionality. There are a number of different ways that this can be beneficial. The more hard drive space you have, the more shows that can be recorded before other shows need to be erased. Every hour of HD recording will take up about 6-7 GB of hard drive space, so you should have enough room to accommodate the number of shows you plan to keep. This section can be upgraded at any time, so if you find later that the hard drive you purchased is too small, you can easily get another one and connect it to the system.

Another benefit to more investment on hard drives is the ability to set up a RAID configuration. A RAID (Redundant Array of Inexpensive Disks) configuration makes a redundant copy of everything stored on a hard drive. This means that if you purchase two 500 GB hard drives, the total storage capabilities of the drives combined will only be 500 GB, but in case the main drive crashes, all of the information is backed up on the other drive.

Recommendations

Again, this section comes down to personal preference. If you plan to have valuable or irreplaceable film stored on the Media Center, or would just like to have a backup of all of your data, I would highly recommend implementing a RAID configuration. It will double the cost of your hard drive implementation so decide whether you think you need the extra protection.

As far as sizing the hard drive, I recommend a minimum of 500 GB of storage but I could easily see moving up to 1000 GB (1 TB). In addition to about a 500 GB drive, ensure that the device has at least the following characteristics: 7200 RPM and SATA 3.0 GBp/s. The 7200 RPM specification relates to the speed that the hard drive is spinning which is directly proportional to how fast data can be read off or saved to the drive. The SATA 3.0 GBp/s specification is saying that the drive uses the SATA communication standard and can communicate with the motherboard at a speed of 3 GB per second. These specifications are preferred because, in most cases the rate at which data can be read from the hard drive is the limiting factor to process speed. These communication rates will provide enough speed that there should be minimal delay to the system.

DVD Player

<u>Function</u>

The function of the DVD drive is to play CDs, DVDs and possibly Blu-ray discs.

<u>Increased Investment</u>

There are three basic versions of the DVD playback device. The first is a basic CD/DVD player which will almost always have DVD and CD recording capabilities. The second stage device will have all of the previously mentioned functionality with the addition of Blu-ray playback. The final stage device has CD/DVD playback and recording as well as Blu-ray playback and recording.

<u>Recommendations</u>

If you do not have an HD TV and do not plan to get one in the near future there is no reason to upgrade to either the Blu-ray player or the Blu-ray recorder because you will not see any of the benefit. However, if you do have an HDTV (especially a 1080) it may be worth the upgrade from a basic DVD player to a Blu-ray player. The cost of a DVD only player is about $20 and the cost of a Blu-ray player (which also plays regular DVDs) is about $100 so make the decision based on whether or not you plan to use Blu-ray in the future. I do not see a time when a Blu-ray burner is a necessity so this decision should be based on whether or not you see yourself using it.

Tuner Card

<u>Function</u>

The tuner card is the component that allows for parsing of the television input. The quality of these devices varies based upon the desired functionality. There are analog tuners, digital tuners and combinations tuners which combine an analog and a digital tuner. The analog tuners are able to parse the information coming from the normal non-HD cable channels. The digital tuners are able to parse the digital information on the line which is usually only the free HD channels (QAM format) unless more HD channels are purchased. Many tuners also come with an FM Tuner input to play the radio as well.

<u>Increased Investment</u>

Increased investment can provide a greater number of cable inputs that increase the number of shows that can be watched or taped at once. This can also be accomplished using multiple tuner cards.

<u>Recommendation</u>

A combination analog and digital tuner would be the best choice for the tuner. They are not significantly more expensive than their counterparts, and they provide increased functionality and flexibility. If you plan to use Windows Media Center I recommend selecting a tuner card that comes with a Windows Media Center certified remote (this will be listed on the packaging). This is important because it will allow you to control the functionality of the Media Center using a remote.

Power Supply

<u>Function</u>

The function of the power supply is to convert the incoming power from the wall socket into levels that can be used by the different components in the Media Center. Different power supplies have different power ratings and the power rating specifies the maximum amount of power that the supply can support. It is important to select a power supply that meets the maximum power ratings for your Media Center.

<u>Increased Investment</u>

Increased investment on this component can increase the maximum power output of the power supply, increase the efficiency of the power supply or some combination of these. Increased power output beyond the recommended levels is only necessary if either an extensive RAID setup is going to be used, or if there are plans to consistently upgrade the Media Center with newer hardware. Increased efficiency will result in less heat generated which will in turn require less fan speed to cool and thus a quieter supply.

<u>Recommendation</u>

It is very important to ensure that the power rating of your power supply is enough to run all of the components in the Media Center. This can get fairly complicated when it comes to choosing a power supply that is just right for all of the components you select. My recommendation would be to overestimate the requirements of your system when deciding on the supply. For the Media Center being built, a 600 W supply should be more than enough, though you could probably get away with a 500 W if the selected

video card is not top of the line. If you plan to use multiple hard drives and multiple tuner cards I recommend increasing to a 700 W supply.

Video Card

Function

The purpose of the video card is to take the data from the Media Center and output it to an external display. In a regular PC, this display is generally a monitor, however, in the case of a Media Center PC, this display will be a TV.

Increased Investment

Since there will be a separate tuner card, the video card is not going to be working as hard as it would in a high performance desktop. This means that a top of the line video card is not necessary and in most cases will provide no added benefit. The most important thing is to select a video card with the desired output capabilities.

Recommendation

The most important factor in selecting a video card is to choose a card that can connect to your TV. There are two main methods for connecting to a TV. The first is via HDMI. If this is the case you need to be sure that the card has an HDMI or DVI interface (if it has only a DVI interface you will need to purchase a DVI to HDMI converter cable unless the card comes with an adapter which is also common). The other method uses S-Video (or composite). I would NOT recommend using the S-Video or composite adapter for HDTV. Depending on the type of television you have be sure to make the correct selection. To determine your output requirements, look on the back of the display and

look for the input connection types used. If you are unsure what each connection is, see Appendix A: Connection Types.

Given your output requirements, I recommend selecting a video card with that output built in (or at least one that comes with the necessary adapter). The two major video card types are NVIDIA and Radeon (ATI), and I recommend selecting an NVIDIA card if possible because I have had better results using them in the past.

Wireless Card

Function

The purpose of the wireless card is to connect to a network wirelessly. This will allow the Media Center to connect to the internet without the use of a cord, similar to a laptop computer.

Increased Investment

A wireless card is a fairly basic piece of hardware so there is no real benefit to spending a significant amount of money on it. The only reason I see for getting a top of the line wireless card would be if the wireless internet source were going to be a significant distance from the Media Center.

Recommendation

I only recommend getting a wireless card for those people who do not have easy access to an internet cable in the room with the Media Center. For people with Ethernet wiring in their house or an internet source very close to the Media Center, I recommend running an internet cable directly to the Media Center as the connection speed will be

greater. For people who will require a wireless card, I recommend a very basic model, spending no more than $30.

Operating System

Function

The purpose of the operating system is to provide the graphical interface for using the Media Center. It acts as an easy to use mask over the complicated tasks that the Media Center will be performing in order to complete your requests.

Increased Investment

Depending on your level of knowledge, a small amount of investment is necessary in order to make the process possible. Free operating systems specifically designed for Media Center applications include MythTV and Freevo. In my experience, they were difficult to configure and unless you have a fairly significant background in using command line Linux, I would avoid using these.

Microsoft has designed an easy to use Media Center that is available on both Windows Vista Home Premium and Windows Vista Ultimate. The Home Premium edition is less expensive than the Ultimate edition and provides all of the same Media Center functionality, so there is no reason to upgrade to the Ultimate edition.

Recommendation

If you already have a copy of either Windows Vista Home Premium or Windows Vista Ultimate, I would not purchase any new software and simply use one of the licenses you already own. If this is not the case, I recommend purchasing an OEM (system

builder) version of Windows Vista Home Premium, as it provides the least expensive methods of acquiring Vista Media Center.

MY MEDIA CENTER

This section will discuss the hardware and software that I chose for my Media Center. In many cases the parts that I chose were more powerful than was necessary but I plan to run multiple tuner cards and configure them to display on multiple screens, so this should be seen as a maximum for spending.

Case

The case I chose was a black Thermaltake (model VB8000BNS) for about $110 plus shipping. I chose this case because it provided a lot of space for expansion and a sleek appearance that would look nice near the TV.

Figure 1 – Thermaltake VB8000BNS (Saucertek))

Motherboard

The motherboard I chose was a Gigabyte GA-EP45-DS3L for $100 with free shipping and a $15 mail in rebate. I chose this motherboard because it had a nice sound card with optical and coaxial sound out in addition to the normal

Figure 2 – Gigabyte GA-EP45-DS3L (Acetech)

3.5mm jacks. It also has an adequate number of SATA connections and enough PCI and PCI-e expansion slots.

Processor

The processor I chose was an Intel Pentium E2220 Allendale 2.4GHz for $85 and free shipping. I chose this processor because it was fairly inexpensive and powerful enough for any of the tasks that it would be asked to do. I also tend to prefer this generation of Intel processors over the same generation of AMD processors.

Figure 3 - Intel Pentium E2220 CPU (Gizmodo)

RAM

The RAM I chose was Kingston HyperX 4GB (2 x 2GB) for about $50 with free shipping. I chose to get 4GB of ram because it was only about $20 more for 4GB than 2GB and I felt like a little more money was worth it. I did not choose high performance RAM so I selected one of the less expensive models and it is working with no problems.
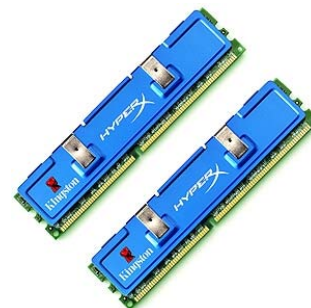

Figure 4 - Kingston HyperX RAM (Tiger Direct)

Hard Drive

The hard drive I selected was a 750 GB Western Digital Caviar with SATA connection (model number WD7501AALS) for about $90 with free shipping. I chose this hard drive because I felt that for the initial build 750GB

Figure 5 - Western Digital WD7501AALS (Buy.com)

was enough storage space and it was a SATA connected hard drive.

DVD Player

The DVD player I chose was a LITE-ON DVD Burner with a SATA connection (model iHAS122-04) for $22 with free shipping. I chose this player because I have always had good experiences with LITE-ON and this

Figure 6 - LITE-ON iHAS122-04 (CompuMusic)

provided a cheap DVD player with a SATA connection. I do not have any Blu-ray discs so I did not need a Blu-ray player, however, LITE-ON did have a reasonably priced Blu-ray player.

Tuner Card

The tuner card I chose was a Hauppauge WinTV-HVR 1800 with a Windows Media Center kit for $100 with free shipping. I chose this tuner card because Hauppauge has a very good reputation with their products, and this model came with a media kit (Windows Media Center compatible remote and accessories). In

Figure 7 - Hauppauge WinTV-HVR 1800 (Fontrier PC)

addition, it had a PCI-e connection which I had plenty of on the motherboard.

Power Supply

The power supply that I chose was a 730 W Raidmax hybrid 2 (model RX-730SS) for $85 with a $30 mail in rebate. I chose this power supply because it had good reviews and was

Figure 8 - Raidmax RX-730SS (ShopBot)

very cheap (only $55) considering the available power of the supply. I selected such a

large power supply so that I could upgrade the number of tuner cards and hard drives in the future.

Video Card

The video card I selected was a Radeon HD 4830 with 512 MB on-board memory (model Powercolor AX4830) for $100 with a $20 mail in rebate. I chose this video card because it had an HDMI output built into it and this was my preferred method for attaching to my

Figure 9 - Powercolor HD 4830 (Scan)

TV. I would not select this card unless you are looking at it explicitly for the HDMI output as I have had some issues with it. It could be my inexperience using Radeon cards, but I would definitely recommend an NVIDIA card over a Radeon card in the future given the troubles I went through getting it configured.

Wireless Card

The wireless card I selected was a D-Link WDA-1320 for $18 before shipping. I selected this card because it was inexpensive and would provide the basic wireless capabilities I needed.

Figure 10 – D-Link WDA-1320 (Smarter)

Operating System

The operating system that I selected was Windows Vista Home Premium 64-bit for system builders for $100 with free shipping. I selected this operating system after two weeks of working with MythTV

Figure 11 – Windows Vista Home Premium (Dungy Discount)

and trying to deal with hardware and software incompatibility issues. The Windows Media Center is very polished and provides all of the features I wanted in an easy to use package; it even provides a free TV guide which needed to be purchased when using MythTV.

Total

The total cost for this build was about $800 which, while expensive, provides a savings of about half when compared with pre-built systems of this caliber. It also provides the ability to easily upgrade as new technology is developed or comes down in price.

PURCHASING PARTS

There are multiple places to purchase Media Center components including factory chains (ex. Fry's Electronics) or online retailers (ex. Newegg.com). Online retailers will provide the most variety, but there are no sales associates to ask questions. I recommend using an online retailer (my favorite is Newegg.com) to look for each component and to go to a store to ask questions if you run into a problem. The reason I prefer online retailers is because their selections are enormous and there are usually lots of user reviews about each product so you can get feedback on whether the part lives up to its promises. Additionally, online retailers are generally less expensive than a physical store. Many online retailers also have very powerful search engines and provide side-by-side comparisons of different products to help you make the right decision.

Assuming that you are using an online retailer, I recommend spending some time browsing through each of the component sections while slowly refining the search until

you find what you are looking for. Unless you are going to be making the purchase immediately, I would not worry about sale items at first. Focus your initial search on selecting the parts that best match your needs. Once you have a product (or a couple options) selected for each necessary category, watch the prices over the next couple weeks because online retailers have lots of sales and frequently provide free shipping promotions for various products.

BUILD PROCESS

If you are using the same case that I did, the build process should be fairly simple because I will go through the process step-by-step. For people who selected a different case, I will go over some of the thought process that should be approached at the start to prevent trouble later. The largest piece that needs to be put into the case is the motherboard, and it also provides the skeleton to build from. For this reason, it seems like a logical piece to put in first, however, this can lead to problems depending on the space constraints of your case. The biggest problem I have found with this is that when trying to install the hard drive, CD-ROM drive or power supply after the motherboard is already installed, there is not enough space to slide them past. For this reason, I recommend installing the hard drive(s), CD-ROM drive and power supply before placing the motherboard (for this part use your own judgment on whether or not the drives need to be installed first).

The following is a step-by-step process of the build using my components. This is assuming all parts are ready to install. The only tool required for this build is a Phillips head screwdriver.

Opening the Case

Open the case by removing the finger screws from the back side of the case and sliding the top back. Lift the top off and set it aside as you will not need it until the build is complete.

Preparing the case

Remove the two metal support frames that span over the opening by removing one screw from each support and lifting them out. See Figure 12 for an example as the first support frame is removed. These frames can be either

Figure 12 - Removing Support Frames

bent up or completely removed from the case. I recommend completely removing them as they just get in the way during the build.

Installing the back plate

Since this case is large enough to install the motherboard before the hard drives, we will put it in first. In order to prime the case for the motherboard you must first remove the generic plate on the back of the case and replace it with the one that comes with the

Figure 13 - Installing Back Plate

motherboard. To remove the plate, knock it out using the back end of the screw driver by hitting it from the outside so that it falls into the case when it pops out. Install the new plate by lining it up (as seen in Figure 13) and pressing until it clips into place.

Installing mounting screws

Since the case is metal, the motherboard cannot sit directly on top of it when the power is running, so we need to put in spacers to hold the motherboard away from the case. Provided with the case will be gold pieces with a male screw end and a female screw end. Lay the motherboard down so that it lines up correctly with the back plate (it will not line up yet because there are no riser screws in, but just set it in the case in the right position). Note the location of each of the mounting holes (see Figure 28) so that you can identify which holes in the case require mounting screws. Remove the motherboard from the case, and, using your fingers, screw the golden mounting screws into the places that correspond to the mounting holes (see Figure 14).

Figure 14 - Installing Riser Screws

Installing the motherboard

There will be various types of screws that came with the case, so take a minute to figure out which type of screw fits correctly into the riser screws. Now place the motherboard on top of the riser screws so that it lines up with the back plate installed in Step 2 (note: the motherboard should be at the 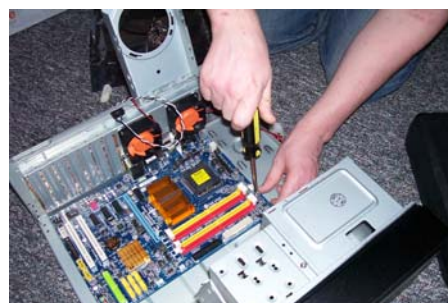correct height now to line up with the back plate). Push the motherboard into the back plate so that the mounting holes line up with the mounting screws and place a screw in each hole (see Figure 15).

Figure 15 - Screwing Down the Motherboard

Installing the hard drive

Unscrew the hard drive enclosure and remove it from the case (see Figure 16). There are three screws securing this piece into the case (two on the side and one on the top). After removing these screws, the piece lifts easily out of the case. With this piece out, slide the hard drive into one of

Figure 16 - Removing the Hard Drive Enclosure

the slots and screw it in. The next step will be done before replacing this enclosure, so set it aside for now.

Installing the CD-ROM drive

Open the CD-ROM bay by pressing on the front of the case and letting the door drop down. The metal plate blocking the drive bay is held in place by four screws. Two of the screws are on the side of the case and two are on the inside where

Figure 17 - Installing the CD-ROM Drive

hard drive enclosure was. Once these screws are removed, this metal plate should easily slide out and the CD-ROM drive can slide in through the front (see Figure 17). Once installed, line up the screw holes on the drive with the holes on the case and replace the screws you just removed. Also, you can now replace the hard drive enclosure and secure it with its three screws.

Installing the CPU

This part is very sensitive and should be done quickly to avoid getting any dust either on the CPU itself or in its socket. I recommend reading over this section as many times as necessary to get an understanding of what to do before attempting this step. For this explanation, reference Figure 18.
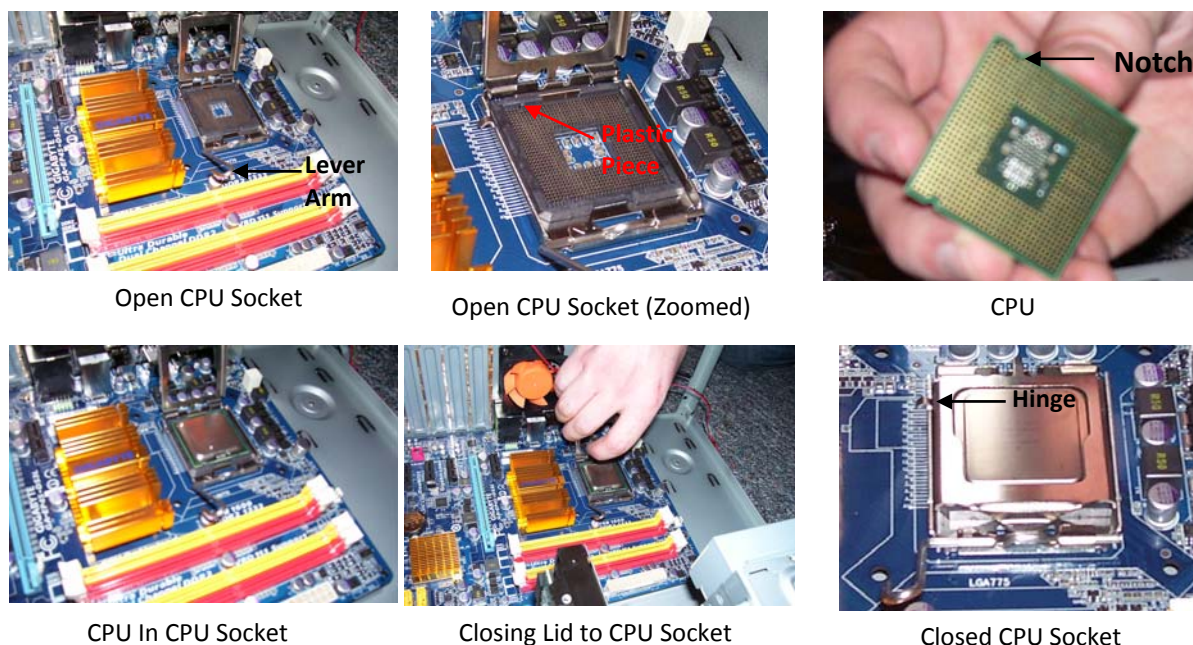

Open CPU Socket

Open CPU Socket (Zoomed)

CPU

CPU In CPU Socket

Closing Lid to CPU Socket

Closed CPU Socket

Figure 18 - CPU Installation Process

To open the CPU socket, press the lever arm (metal piece with the cane-like end) down and slide it out from the hinge. The lever can then be flipped completely over to allow the socket to open. The open socket is in the shape of a square with small plastic pieces on two sides that prevent it from being a perfect square. These protruding plastic pieces are to ensure that the CPU is installed correctly. As you can see in the picture labeled CPU, there are notches on the processor that should be aligned with the protruding plastic pieces of the socket. Once you identify the correct direction, insert the processor and close the lid to the CPU socket. To lock the lid closed, flip the lever arm back to the locked position and secure it on the hinge. You will not be installing the heat

sink (the fan that came in the processor package) yet because it is fairly large and gets in the way, so for now just set it aside.

Installing the RAM

This part of the installation depends on the number of RAM sticks that you are using. If you are using 2GB in the form of 2 x 1GB or 4GB in the form of 2 x 2GB you need an extra step to ensure that the RAM is installed properly. On the

Figure 19 - Installing RAM

motherboard, you need to identify the RAM slots which may be in multiple colors. If so, ALL of one color must be filled before you begin filling another color. This means that for my build, where I am using 4 GB in the form of 2 x 2GB sticks, I will be installing RAM in only the yellow slots (the color used is not important, I could have chosen to use the red slots without problem). If in the future I upgrade, I can fill in the red slots as necessary. To install the RAM, open the slots by unhinging the white side pieces and pressing each stick of RAM into place. There is only one direction that the RAM will go in, so if it is not sliding in, try turning it around. Once the RAM is pressed down, lock the white side pieces to secure the sticks in place.

Installing the expansion cards

Identify the PCI-e x16 expansion slot on the motherboard. Attempt to line the video card up with this slot and look to see which slot in the case the video card is occupying. Remove the metal covering from this expansion slot. This can be done

Figure 20 - Installing the Video Card

from the outside of the case by applying some force to the bottom of this covering until it pops out. Once this slot is completely open, press the video card into place by lining the connection up with the PCI-e x16 slot until it clips into place (see Figure 20). Find one of the screws that are provided with the case to secure the bracket to the case. Repeat this process for the wireless card (using a regular PCI slot) and the tuner card (using a PCI-e x1 slot). I installed the tuner card in the PCI-e x1 slot on the side of the video card opposite the fan because I was not able to plug it all the way in, due to the orange heat sink on the motherboard.

Installing the Power Supply

Set the power supply down in the case with the fan facing into the case (see Figure 21). Slide the power supply back so that it is meshed with the back of the case. From the back side, line up the screw holes on the power supply with the holes in the case

Figure 21 - Power Supply Installation

and use the screws provided with the power supply to secure the supply to the case.

Motherboard Power Cable

The motherboard has a special connection that comes out of the power supply. Find the connector seen in Figure 22 and connect this to the power socket for the motherboard (see Figure 28). This connector comes as two pieces to provide functionality for multiple motherboard types. For the purposes of this build, it will

Figure 22 - Motherboard Power Connector

function as a single connection and will be plugged in with the arrows pointed together (the connector will fit into the socket only one way).

PCI-e Power Cable

The video card used in this build requires more power than the motherboard can supply from a PCI-e x16 slot so an extra connection to the power supply is required. Find the cable (with red tips) that came with

Figure 23 - PCI-e Power Connection

the power supply that is marked PCI-e and connect to the cable coming out of the power supply with the same markings (see Figure 23). Plug the other end of this cable into the power connection on the video card. This connection will be at the end of the video card and will fit in only one direction.

SATA Power Connections

Both the hard drive and the CD-ROM drive require power from the power supply. In the cables that came with the power supply, find the cables with a SATA connection at one end and the black power supply connection at the other. If you are unsure of what a

SATA connection looks like, see Appendix A: Connection Types. Connect the non-SATA end of this cable to one of the available connections on the power supply and connect the other end to the power input on the CD-ROM and hard drive (see

Figure 24 - Connecting Power to Hard Drive

Figure 24). Depending on the distance between the hard drive and CD-ROM drive you may need to use two separate cables and connect them independently.

Fan Power Connections

The case fans each require a 4-pin molex power connection to run and can be connected together in series. In the cables included with the power supply, find one with a 4-pin molex connection (see Appendix A: Connection Types for help identifying the cable) on one end and the
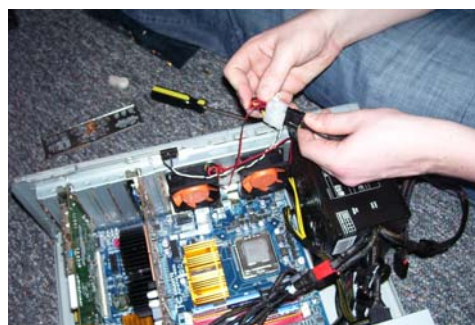

Figure 25 - Connecting Fan to Power

black power supply connection on the other. Connect the appropriate end of the cable to the power supply and connect the other end to one of the molex connections on the fans (see Figure 25). From there, you can connect the power from different fans together rather than running another cable from the power supply. These types of connections can be frustrating because the pins in the male connections can come loose which will prevent them from easily clipping together. If this is the case try to straighten the pins out as best as possible and slowly push the connection together. For this case there are two fans in the back near the power supply and another near the front behind the LCD display, for a total of three fans to connect.

SATA Data Connections

To connect the data lines of the CD-ROM drive and the hard drive, the SATA cables that came with the motherboard are needed. Find two cables (in this case, yellow) with SATA connections on both ends. Plug one end of the
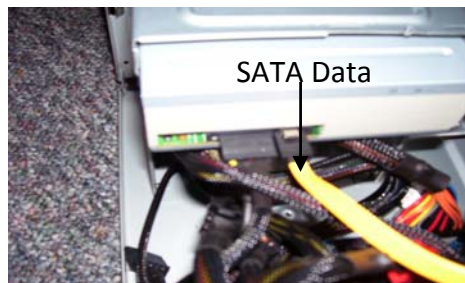

Figure 26 - SATA Connection to CD-ROM

cable into the any of the SATA data connections on the motherboard (see Figure 28) and the other end into the data plug (just to the right of the power connection) on the CD-ROM drive. Make sure to do this for both the hard drive and the CD-ROM drive.

Connecting the Front USB ports

Find the cable that is connected to the case with an end piece labeled "USB". It should be coming out from somewhere towards the front of the case, most likely right behind the LCD screen. Plug this cable into one of the additional USB connections on the motherboard (see Figure 28).

Installing the CPU Heat Sink

To connect the heat sink, start by getting it ready to plug into the motherboard. Turn all of the arrows on the heat sink feet such that the tail end is closest to the fan (see Figure 27). Once this is done, set the heat sink on top of the processor while lining the feet up with the CPU heat sink holes (see Figure 28). Once you are sure

Figure 27 - CPU Heat Sink

each of the feet are lined up correctly, firmly press on two opposite corners to lock the feet in. Once those corners are locked down, switch and press on the other corners to lock them down. Once the heat sink is locked down, unravel the cable wrapped around the fan enough that the fan can spin freely without hitting any part of the cord. Plug the end of this cable into the CPU fan power slot (see Figure 28)

Installing Case Connections

Find the case connections port on the motherboard (see Figure 28). Adjacent to it will be labels of how to connect the case to the motherboard. The following labels on the motherboard will correspond to cables coming from the case: Power SW (Power Switch), Reset SW (Reset Switch), Power LED (LED to show there is power to the motherboard), HDD LED (LED to show hard drive activity), and finally Speaker (internal motherboard speaker or beep). On the motherboard, there will be labels of positive and negative (+ and -) for each of these connections. For each pair of cables, the white cable is the negative side so be sure to connect the cables accordingly. Some of the cables (Power SW and Reset SW) can be connected in either direction so there might not be a white wire.

Finishing Up

Check that all of the wires are kept away the fans as best as possible as it will be very loud if one of the wires gets caught in a fan. This can be done using plastic twist ties and connecting large groups of wires together to prevent loose wires from changing position. Carefully replace the lid (look out for loose cables) that you removed in the first step.

SOFTWARE INSTALLATION AND CONFIGURATION

This section will provide a step-by-step guide for installing Windows Vista Home Premium and for installing the hardware drivers. It will then explain the process necessary to configure Windows Media Center. For this section a mouse and keyboard (either USB or standard connection) are required and it is easiest to use a regular computer monitor.

Installing Windows Vista Home Premium

1. Turn on the computer and insert the Windows CD.

2. Restart the Media Center.

3. When prompted, press spacebar to boot the computer from the CD.

   If your computer boots from the CD move to step 4, otherwise:

   a. Restart the Media Center.

   b. At the initial loading screen, press the appropriate key to enter BIOS setup (this key will be listed as the Media Center starts up and it is frequently either delete or f10).

   c. Using the arrow keys, scroll down to "Advanced CMOS Settings" and press "Enter".

   d. Scroll to "Primary Boot Device" and press "Enter".

   e. Scroll to "CD-ROM" and press "Enter".

   f. Save your settings (f10).

   g. The Media Center should automatically restart. Return to the start of step 3 (booting from the CD).

4. Select your location and click "Next".

5. Click "Install Now" (there is a significant wait after this set).

6. Enter the CD-Key that came with your Vista CD, click Next.

7. Read the license terms, and check the "I accept the license terms" box. Click "Next".

8. Click on the "Custom (advanced)" installation.

9. Select the drive where you would like to install Windows and click "Next" (WARNING: this will erase all data currently on that drive).

   a. If you would like to partition your drive you can do that now, however since the Media Center operating system will be controlling data storage this is not really important.

   b. If you have more than one drive, either one may be selected to install Windows.

10. Select "OK" assuming you wish to erase all data on the drive.

11. Eventually, the Media Center will restart; do not press anything. You should soon see a screen that says "Please wait while Windows sets up your computer".

12. Enter a user name and password (password optional), click "Next".

13. Choose a computer name (to be seen on the network) or use the default and click "Next".

14. Click "Use Recommended Settings" for automatic updates.

15. Select your time zone, click "Next".

16. Click "Start".

17. OPTIONAL: When the computer starts up you can uncheck the "Run at startup" for the Welcome Center as it is annoying and gets in the way.

Note: If you enabled automatic updates (recommended), when restarting during the following steps there may be some Windows updates that occur during the shutdown process. This is normal, as Windows is trying to get itself up to date.

Motherboard Configuration

1. Insert the CD that came with your motherboard into the CD-ROM drive.

2. Click on option under "Install or run program" at the prompt.

3. If the prompt does not come up:

    a. Click on the window in the bottom left hand corner of the screen.

    b. Click on "Computer".

    c. Double click on the CD drive to open the installer.

    d. If you get an application error, right click on the CD drive and click "Open".

    e. Double click on the "Setup" file.

4. Click "Continue".

5. If the CD has an "Install All" option, use this. This will most likely cause the Media Center to restart a few times. Wait until it is completely done to proceed to the next step.

    a. If there is no such option, install each of the features individually, restarting the Media Center when necessary.

Anti-Virus (not necessary on a Media Center):

1. Since the Media Center will not be used as a desktop, anti-virus is not essential. If you happen to have an available copy it wouldn't hurt to install it.

2. Insert the anti-virus CD.

3. Click on the option under "Install or run program" at the prompt.

4. Click "Continue" (if applicable).

5. Follow the directions to install the anti-virus.

6. Once completed, be sure to update the protection files.

Graphics (Display) Configuration

1. Insert the CD that came with your graphics card into the CD-ROM drive.

2. Click on the option under "Install or run program" at the prompt.

3. For a Radeon Card (HD4830):

    a. Click "Yes" to allow the installer to open in Internet Explorer (if applicable).

    b. Click the option that best describes your graphics card "Windows VISTA DRIVER for HD4830/HD4350 Display Card".

    c. Click "Run".

    d. Click "Continue".

    e. Click "OK" at the Catalyst install window.

    f. Select a language and click "Next".

    g. Click "Install".

    h. Click on the "Express" button and click "Next".

    i. Click" Accept".

    j. Click "Yes" to create the folder (if applicable).

    k. Click "Finish".

    l. Click "Yes" to reboot the computer.

4. For an NVIDA Card, follow the directions of the install prompt, selecting the default values if you are unsure.

Wireless Card Configuration

1. Insert the CD that came with the wireless card.

2. Click on the option under "Install or run program" at the prompt.

3. Follow the instructions to install the driver.

4. Restart the computer.

5. To connect to your wireless network:

   a. Right click on the icon in the bottom right hand corner of the screen that looks like two computer monitors stacked on one another.

   b. Select "Connect to a network".

   c. Select your wireless network from the list and click "Connect".

   d. Enter the wireless password (if applicable).

Tuner Configuration

1. Insert the CD that came with the tuner card.

2. If no install prompt comes up:

   a. Click on the window in the bottom left hand corner of the screen.

   b. Click on "Computer."

   c. Double click on the CD drive to open the installer.

   d. If you get an application error, right click on the CD drive and click "Open".

   e. Double click on the "Setup" file.

3. Click on "Install Drivers" and wait for the installation to finish.

4. The WinTV application is not necessary if you plan to use the Vista Media Center. Note: If you need QAM decoding capabilities you can download a Media Center add-on from: ftp://ftp.shspvr.com/download/mce_clear_qam/mceclearqam-plugin.zip.

5. Remote Control Setup:

   a. Connect the smaller end of the USB cable to the IR receiver that came with the remote.

   b. With the Media Center powered up, plug the larger end of the USB cable to a USB port on the Media Center.

   c. Wait for the prompt in the bottom right corner to say "Your device is ready for use" (if this does not happen, unplug the USB cable and try another USB plug in the Media Center).

Enabling Windows Media Center

1. Shut down the Media Center.

2. With the power off, plug in the correct input signal to your Media Center:

   a. Selecting the correct input signal:

      i. Simple Method:

         The simplest way to connect to know which method to use is to look at how the TV currently gets its input. If a coaxial cable is plugged into the TV you should use Option 1. Otherwise, you will want to use Option 2.

      ii. More Complex Method:

         If your television provider uses a set top box (cable or satellite box) between the initial input and the television, you will most likely need

to use Option 2; however this can differ depending on the input signal type provided by the company. If your provider is using an analog signal (still possible even after the digital transition which only applies to over the air signals) or a digital signal in free QAM digital encoding (many Fios providers) you can use Option 1 and skip the set top box entirely. If you do not know which method your provider uses, you can always try Option 1 and if you are missing channels that you had previously, you can re-do the procedure using Option 2.

b. Option 1, Coaxial Cable:

    i. The best thing to do here is to use a cable splitter and connect the cable to both the analog and digital inputs on the tuner card. A cable splitter can be purchased at any store that sells electronics and often looks like 'T' with one input and two outputs. This will allow access to all of the analog channels as well as the free QAM digital channels and even allow recording of one analog channel while watching a digital channel or vice versa.

c. Option 2, S-Video or Yellow Composite Video and Red/White Audio inputs:

    i. Connect the Audio cables (Red / White tipped cables) from the output of the set top box to the input of the tuner card. Use the color coding on the cables to connect the correct ports on each device.

    ii. If the set top box has an S-Video output, this is the preferred method to connect video between devices. Otherwise, using the S-Video to

Yellow RCA adapter, connect the yellow part of the RCA cable between the set top box and tuner card.

iii. If you are using this option and would like your Media Center remote to control the functionality of your set top box, connect the IR transmitter cable into the USB receiver installed in the previous step. Place the other end of the IR transmitter over the IR receiver on your set top box (the LCD screen on the front of the device that displays either the time or current channel).

Configuring Windows Media Center

(Note: you must have an internet connection to complete this section):

1. Ensure batteries are in the Media Center remote.

2. Point the remote at the USB receiver that you installed and press the Windows button (green circular button in the middle of the remote).

3. Windows Media Center should start up. If it does, proceed to step 4.

   a. When you press the Windows button on your remote, the green light on the remote should light up momentarily. If this does not happen, ensure the batteries are installed correctly way and/or replace the batteries.

   b. When you press the Windows button on the remote (while pointed at the USB receiver) a red light on the front of the receiver should light up momentarily. If this does not happen try:

      i. Re-positioning the receiver so that there is a clear line of sight between the remote and the receiver and try again. Press the Windows button on the remote again.

      ii.   Unplugging the receiver from the Media Center and plugging it in to a different USB port. Press the Windows button on the remote again.

4. You can use the remote for the rest of the Media Center setup.

5. Once the Media Center has started up, choose "Express Setup" and follow the instructions until you reach the main menu (a blue screen with various media options that you can scroll through).

6. At the Windows Media Center home screen, scroll down to "Tasks".

7. Scroll left to "Settings" and press "OK".

8. Scroll down to "TV" and press "OK".

9. Scroll down to "Set up TV Signal" and press "OK".

10. At the first screen, select "Next" by pressing "OK".

11. Select the region you are in (United States is the default) then select "Next". Media center will then acquire the most up to date settings for this region.

12. If you selected Option 1 (coaxial cable) input connection for your tuner card, select "Configure my TV signal automatically". Skip to step 26. Otherwise select "I will manually configure my TV Signal" and press "Next".

13. Select which type of TV signal you receive (Cable / FIOS or Satellite). Press "Next".

14. Select "Yes" that you do have a set top box and press "Next".

15. Turn on all necessary devices and press "Next".

16. Media center will determine which input channel is being used to connect to the tuner card and show a small preview. Press "Next".

17. If you would like to have your Windows Media Center remote control your set top box select "Yes", otherwise select "No". Press "Next". If you selected "No", skip to step 26.

18. Press "Next".

19. Follow the on-screen directions using your <u>set-top box remote</u> to determine signal codes.

20. At the next screen, using the Media Center remote again, select "Next".

21. Select the maximum number of digits allowed by the set top box (number of digits of the highest channel that you can receive). Press "Next".

22. Select whether or not you have to press Enter/OK after selecting a new channel or if the channel changes automatically. Press "Next".

23. Enter the channel number of a known working channel to ensure that the channel changes correctly. Select the appropriate box and press "Next".

24. Quickly change the channel using the arrow keys and see whether the appropriate channel is selected. Select the appropriate box and press "Next".

25. Press "Next" to accept the IR transmitter speed.

26. Select the appropriate box for the Digital TV Antenna. If you are unsure, select "No" and then press "Next".

27. Select "Set Up Guide listings" to configure the Free TV guide channel for your area. Press "Next".

28. Press "Next" to confirm guide setup.

29. Select "Yes" and press "Next".

30. Read through the Terms of Service and select "I agree". Press "Next".

31. Enter your Zip code and press "Next".

32. Windows Media Center will connect to the internet to determine the available providers in your area. Select the appropriate provider and then press "Next".

33. Windows Media Center will connect to the internet to download the guide for this specific provider (this may take a few minutes). Press "Next".

34. You should now be able to return to the main Media Center screen (either by pressing back or the Windows button), scroll up to TV + Movies and select live TV.

Navigating Windows Media Center

The Media Center main menu can be navigated using either the Media Center remote control or the mouse and it contains various sub-menus that each provides unique functionality. I will give a brief overview of the purpose of each menu; however the best thing to do is to spend some time playing with the menu. The sub-menus are as follows:

1. "Pictures + Videos":

   This menu allows you to navigate through and view all of the pictures and videos that are saved to the corresponding directories in the "Media_Center" folder. This feature allows you to view saved videos or pictures (possibly home movies from a digital camera) on your television.

2. "Music":

   This menu allows you to navigate through the music that is saved to the corresponding music directory in the "Media_Center" folder. From this menu you can also purchase music from the internet or play the radio if you have an antenna hooked to your tuner card.

3. "Now Playing":

   This menu allows you to view what is currently playing and to immediately return to that selection from the menu.

4. "TV + Movies":

   This menu allows you to watch live TV, watch recorded TV, play a DVD and view the downloaded TV guide. You can also manage the previously recorded shows or set up a future recording.

5. "Sports":

   From the sports section you can see which sports games are currently being played, which games will be played later in the week, or see a summary of sports scores.

6. "Online Media":

   This menu allows you to use some of the built-in online functionality of Windows Media Center. Much of this functionality is optional and many users will never access this section.

7. "Tasks":

   This menu allows you to configure different settings, turn off the Media Center, or interact with external devices (DVD burning, mp3 players, digital cameras, etc).

   Since the Media Center is first and foremost a computer, it has a file system similar to any personal computer. The "Pictures + Videos" and "Music" sub-menus have access to the corresponding folders on the computer. This means that you can save your files to these folders and then access them through the Media Center. To get access to these folders from the desktop view, use the mouse to click on the Windows button in the

bottom left hand corner of the screen and select "Media_Center" from the options on the right hand side. The folders seen from here are accessible through Windows Media Center so any media saved here can be accessed within the Windows Media Center environment.

Connecting the Media Center to your television

1. Turn off the Media Center.

2. Unplug the monitor used during configuration and connect the TV to the Media Center. This connection can be any of the allowed connections (HDMI, DVI, VGA, Composite, etc).

3. Turn the TV on and set its input to be wherever the Media Center is plugged in. This can be done on most sets by pressing the input key on the TV remote until you reach the desired input.

4. Turn on the Media Center.

5. The attached TV should now act as a monitor. If this works, you have completed the TV connection process. Otherwise, move to the next step.

6. Turn off the Media Center.

7. Reconnect the original monitor while leaving the TV still attached.

8. Turn on the Media Center.

9. Right click on the desktop and select "Personalize".

10. Click on "Display Settings" on the pop-up screen.

11. At this screen you should see two rectangles (representing monitors) with numbers in them. Click on the box with the number 2 in it to select it.

12. Select the box that says "Extend my desktop onto this monitor".

13. Select the box that says "This is my main monitor".

14. Click "OK".

15. The TV is now your default main display so you can now shut down the Media Center and remove the original monitor.

Enabling Audio Out:

The first step in enabling the audio output is to identify the desired audio input for the television or receiver. The Media Center built provides the following output possibilities: RCA stereo out, Optical S/PDIF out, Coaxial S/PDIF out, and Audio over HDMI. RCA stereo out will require a 3.5mm to RCA converter cable, however, these are fairly inexpensive. Optical and coaxial out are built directly into the motherboard and are probably the easiest to configure. Audio over HDMI provides some convenient functionality if you are using an HDMI cable as the connection to the television because it reduces the number of cables that are needed. This method requires a driver update (available at: http://drivers.softpedia.com/get/SOUND-CARD/REALTEK/Realtek-ATI-HDMI-Audio-Device-Driver-159.shtml) and will not allow audio (even music) to be played unless the TV is on.

Once you have decided on the method, you need to tell the Media Center which method that you chose. To do this, follow these steps:

1. Click on the windows button in the bottom left hand corner of the screen.

2. Click "Control Panel".

3. Click "Hardware and Sound".

4. Click "Sound".

5. Select the appropriate playback device and then click "Set Default",

      a. RCA Stereo Out – Select "Speakers/Headphones".

      b. Optical / Coaxial Out – Select "Realtek Digital Output".

      c. Audio over HDMI – Select "Realtek HDMI Output".

6. A green check should appear on the new default along with the word "Working".

7. Click "OK".

8. Restart the Media Center.

PROBLEMS ENCOUNTERED

This section will discuss the different steps that created problems and the possible solutions I came up with in hopes that you will not have to repeat my errors.

Digital Transition

When I first started looking into building a Media Center, I was worried about how everything would work with the recent digital transition. It was difficult to know whether tuner cards (especially analog tuners) would still work. I will summarize what this transition means to the Media Center build process and tuner cards. First, the digital transition has a mandatory effect on only over-the-air television transmission (i.e. TV using an antenna for reception). This means that there is no required change to cable or satellite companies.

However, some cable companies are using this opportunity to change their service over to all digital and tying it in with the "digital transition" to prevent people from splitting the signal to unauthorized TV sets. If your cable company requires a set-top box for each TV, this means that they have made a transition to all digital programming (with the exception of channels 2-13). This means that you will either need a tuner card with a

digital input (if the input is in free QAM formatting) or need to connect the tuner card to the set-top box via S-video or RCA connections and use the IR-transmitter to change channels. If you do not need a set-top box and can still plug the cable directly into your TV to view all available channels, the analog input on the tuner card is going to provide the best results.

MythTV

MythTV is one of the free operating systems that provides Media Center functionality. I originally planned to use this operating system instead of Windows Vista because it was free and I was interested in getting some experience using the Linux based operating system. I started with a pre-compiled version of the operating system called Mythbuntu, which is a combination of Ubuntu and the most recent version of MythTV.

I was able to install the operating system and get the Media Center up and running to the driver install stage. It was at this point where I started to encounter problems. Since most people use a Windows based operating system, all of the parts come with Windows drivers, but very few come with Linux drivers. I spent some time on another computer browsing the internet and was able to find drivers for each of the hardware components installed in the Media Center. The motherboard chipset drivers, wireless drivers, and video drivers all successfully installed, however, the operating system was unable to identify the tuner card. Without a tuner card, the Media Center will not have any functionality beyond a regular computer, but I continued the install to see if I could fix the problem.

The configuration process for MythTV was fairly complicated when compared with the same process for Vista Media Center. The install prompts wanted to know

detailed information about the case connections. For example, it asked which PCI port number the tuner card was plugged into, or which PCI-e port number the graphics output would be displayed to. All of this information was automatically determined when using Vista Media Center. Once I got through all of these sections, I configured the TV signal based on which encryption type my provider (Comcast Cable) used and tried to load the guide. It was here that I found the MythTV guide must be purchased by U.S. users for a price of $20 per year which seemed to be counterintuitive for a free operating system.

My solution to this problem was to switch to Windows Vista Home Premium and Windows Media Center. Even though this doesn't seem like a solution so much as another approach, it turned out to be a much better decision. The ease of use in configuring Windows Media Center combined with the free guide definitely makes it worth the initial investment of purchasing the software.

Remote Compatibility

Before purchasing parts, I had planned to use MythTV as the operating system in the Media Center so I spent some time researching the compatible hardware. For this reason I selected an older Hauppauge Tuner that did not come with a Windows Media Center remote. When I tried to use this tuner card with Windows Media Center, it identified the card, but I was not able to use the remote that came with the older version card.

My solution to this problem was to get another tuner card, but one that came with a Windows Media Center compatible remote. This tuner card and remote receiver were immediately identified by Windows and provided control of the Media Center using just the remote.

Receiving Sound from the Cable Box

Before I tried to connect the Media Center to my TV, I wanted to check that the input signal from the cable box was working properly, so I plugged a pair of headphones into the system and tried to watch TV. At this point I was able to watch the desired channel, but there was no sound associated with it. I checked to make sure the head phones were enabled and that the sound in Windows and in the Media Center application were turned up, unfortunately, there was still no sound.

In order to fix this problem I had to remove the tuner card from the system and plug it in to a different PCI-e 1x slot. When I opened the system up, I noticed that the bracket of the tuner card was not as flush with the case as the other expansion cards. After looking closer I could see that the end of the card was hitting the top of heat sink in the case and therefore could not get a complete connection. By moving the card to a new slot that did not have this problem and ensuring that the bracket made a flush contact with the case I was able to receive sound input from the source.

Connecting Video to TV

When I initially connected the HDMI cable from the Media Center to my TV and powered up the system, I still had only video on the main monitor. The most basic thing to check at this point is to ensure that the TV is set to the correct input channel. Check on the TV where the Media Center is connected (Video-1, Video-2, HDMI-1, HDMI-2, etc). If the TV is on and tuned to the correct channel and there is still no picture, this means that the system had not enabled the display to span across multiple screens. To fix this problem:

1. Right click on the desktop and select "Personalize".

2. Click on "Display Settings".

3. There should be two boxes shown on this tab that represent monitors. The box with the number 1 inside represents the main monitor being worked on, and the second box represented the TV I wanted to connect. Click on the second box

4. Check the box "Extend the desktop onto this monitor".

5. Check the box "This is my main monitor". Click "OK".

HDMI Audio

While I was able to get video to display on the TV, I was not able to get sound out of the speakers. To fix this problem, I needed to install an HDMI audio driver and tell the system to use HDMI audio as its default output. To fix this problem:

1. Click on the Windows button in the bottom left hand corner of the screen.

2. Click "Control Panel".

3. Click "Hardware and Sound".

4. Click "Sound".

5. Under the playback tab select the playback device named "Realtek HDMI Output" or "Realtek Digital Output (HDMI)" and click the "Set Default" button. Restart the Media Center.

   a. If neither of these choices exists, download and install the Realtek HDMI driver (Available at: http://drivers.softpedia.com/get/SOUND-CARD/REALTEK/Realtek-ATI-HDMI-Audio-Device-Driver-159.shtml)

   b. Restart the Media Center.

   c. Return to Step 1

BIBLIOGRAPHY

Acetech. <u>Online Image.</u> 23 2 2009 <http://www.acetech.co.nz/shop/images/13552.jpg>.

AT Markit. <u>Online Image.</u> 23 2 2009
      <http://www.atmarkit.co.jp/fsys/cableconnect/05disp_video/03dvi_d-box-l.jpg>.

Buy.com. <u>Online Image.</u> 23 2 2009
      <http://ak.buy.com/db_assets/large_images/151/208190151.jpg>.

CompuMusic. <u>Online Image.</u> 23 2 2009
      <https://www.compumusic.com/Photo.aspx?photo=368533&size=3>.

Cruthfield. <u>Online Image.</u> 23 2 2009
      <http://akamaipix.crutchfield.com/lifestyle/2001/hCompositeVideoJac.jpeg>.

Dungy Discount. <u>Online Image.</u> 23 2 2009
      <http://www.dungydiscount.com/images/windows_vista.jpg>.

Extreme Hardware. <u>Online Image.</u> 23 2 2009
      <http://extreme.pcgameshardware.de/attachments/39277d1223819794-s-4-pin-
      molex- male-stecker-800px-molex_male_connector.jpg>.

Fontrier PC. <u>Online Image.</u> 23 2 2009
      <http://content.etilize.com/Large/1011113076.jpg>.

Gigabyte. <u>Online Image.</u> 23 2 2009
      <http://www.gigabyte.com.tw/FileList/Image/motherboard_productimage_ga-
      ep45- ds3l_big.jpg>.

Gizmodo. <u>Online Image.</u> 23 2 2009
      <http://cache.gizmodo.com/assets/resources/2006/08/IntelCoreDuo2intro.jpg>.

High Def Forum. <u>Online Image.</u> 23 2 2009
      <http://images1.hdpi.com/product_enlarged/philips- SDW5200O-17.jpg>.

Jane Jo Knows. 23 2 2009 <http://janejoknows.com/wp-
      content/uploads/2008/08/composite.jpg>.

JDR Computer Products. <u>Online Image.</u> 23 2 2009
      <http://www.jdr.com/interact/..%5Cimages%5Cproducts%5CC%5Ccbl-hdmi-
      mm.jpg>.

Saucertek. <u>Online Image.</u> 23 2 2009
      <https://www.saucertek.com/shop/images/thermaltake/CA-VB8KBNS.gif>.

Scan. Online Image. 23 2 2009 <http://www.scan.co.uk/Images/Products/903759-a.jpg>.

ShopBot. Online Image. 23 2 2009 <http://www.shopbot.ca/i-
        ca/2008/12/8349573124_small.jpg>.

Smarter. Online Image. 23 2 2009
<http://images.smarter.com/300x300x15/2/16/770016.jpg>.

Tiger Direct. Online Image. 23 2 2009
        <http://images.tigerdirect.com/skuimages/large/kingston-Hyper-Dual.jpg>.

Video Help. Online Image. 23 2 2009
<http://archive.64bits.se/guider/pcbyggarskola/sata.jpg>.

Wikepedia - HDMI. Online Image. 23 2 2009
        <http://en.wikipedia.org/wiki/File:HDMI.socket.png>.

Wikipedia - DVI. Online Image. 23 2 2009
        <http://en.wikipedia.org/wiki/File:DVI_Connector.jpg>.

Wikipedia - Molex. Online Image. 23 2 2009
        <http://en.wikipedia.org/wiki/File:Molex_female_connector.jpg>.

Wikipedia - RCA Connector. Online Image. 23 2 2009
        <http://en.wikipedia.org/wiki/File:RCA_Connector_(photo).jpg>.

Wikipedia - Serial ATA. Online Image. 23 2 2009
        <http://en.wikipedia.org/wiki/Serial_ATA>.

Wikipedia - S-Video. Online Image. 23 2 2009 <http://en.wikipedia.org/wiki/S-Video>.
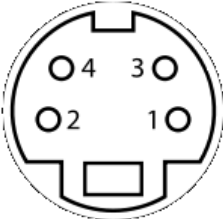
Wikipediea - VGA. Online Image. 23 2 2009 <http://en.wikipedia.org/wiki/VGA>.

Your Broadband Store. Online Image. 23 2 2009
        <http://www.yourbroadbandstore.com/images/large/213848.jpg>.

APPENDICES

Appendix A: Connection Types

Table 1 - Connection Types

Connection Type	Cable	Socket
DVI	(Wikipedia - DVI)	(AT Markit)
HDMI	(JDR Computer Products)	(Wikepedia - HDMI)
S-Video	(Wikipedia - S-Video)	(Wikipedia - S-Video)
Composite Video	(Jane Jo Knows)	(Cruthfield)
VGA	(Wikipediea - VGA)	(Wikipediea - VGA)

Coaxial	(High Def Forum)	(Your Broadband Store)
RCA (For Composite Video and Analog Audio)	(Wikipedia - RCA Connector)	(Wikipedia - RCA Connector)
SATA Power	(Wikipedia - Serial ATA)	(Video Help)
SATA Data	(Wikipedia - Serial ATA)	(Video Help)
4-Pin Molex	(Wikipedia - Molex)	(Extreme Hardware)

Appendix B: Gigabyte GA-EP45-DS3L Top-Side Connections
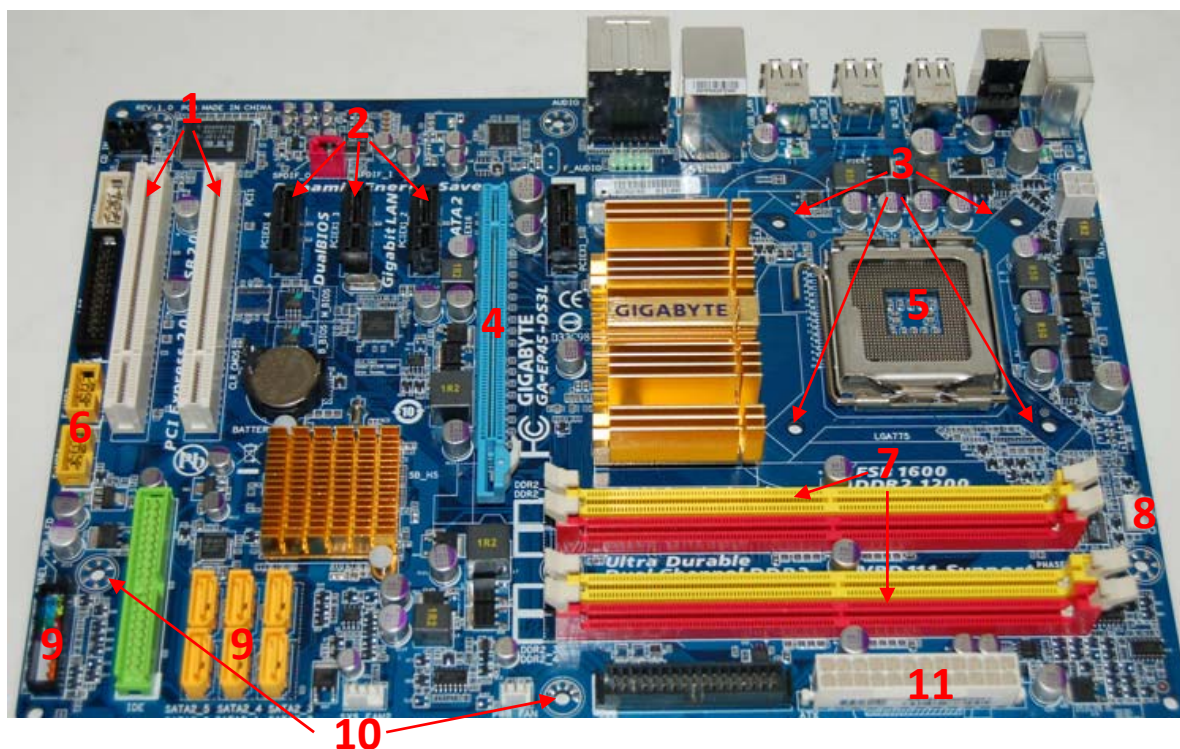

Figure 28 - Large Gigabyte GA-EP45-DS3L (Gigabyte)

1. PCI extender card ports (for wireless card)

2. PCI-e 1x extender card ports (for tuner cards)

3. CPU Heat Sink holes

4. PCI-e 16x extender card port (for graphics card)

5. Processor slot (processor and heat sink will go here)

6. Addition USB connections (will connect to the case to provide front USB capabilities)

7. RAM Slots

8. CPU fan power slot

9. Case connections (power switch, reset switch, power LED, activity LED)

10. SATA Data connections

11. Power socket for motherboard

12. Mounting holes to screw into to raise motherboard off of case