

Workstation Upgrade Manual

Omni Consumer Products

William Matheson
4/10/2012

Table of Contents

I. Introduction	1
II. Best Practices	1
Personal Safety.....	1
Computer Safety	1
Miscellaneous	2
III. Materials List	2
Upgrade Components	2
Tools.....	2
Software.....	2
Other	2
IV. Physical Installation	2
1. Removing the old motherboard	2
2. Installing the new motherboard.....	6
3. Installing the CPU	6
4. Installing RAM.....	8
5. Installing the hard drive.....	10
6. Reconnecting the system panel lights and buttons	11
7. Reconnect power cables and close the case	12
V. Software Configuration	12
1. Updating the BIOS	12
2. Configuring the BIOS	14
3. Setting up and using Windows Update	17
4. Updating drivers	19
5. Copying the image of one workstation to other computers.....	23
VI. Troubleshooting	24
ZIF lever won't close	24
BIOS upgrading – “No Update Module Was Found”	24
Blank screen and beeping at power-up after installing motherboard or memory.....	24
The system will not boot from the LAN / won't connect with the Clonezilla server.....	25
“CMOS Date/Time Not Set / Please enter Setup to recover BIOS setting”	25
CPU Fan Error	25

I. Introduction

In this project, we will be updating our workstation PCs to use current motherboards, processors, hard drives, and RAM. We have already succeeded in configuring a test workstation with an installation of Windows 7 Professional, using a pre-arranged volume licence key. While the hardware and BIOS steps discussed here will need to be applied to all workstations, the software configuration can be cloned over the network using a tool such as Clonezilla SE. We will update the test system to the latest drivers and Windows updates and configure it to receive future updates before we clone it, however.

II. Best Practices

Personal Safety

Before working inside a PC, it's critical to turn it off and to disconnect the power. Flipping the hard power switch on the power supply will interrupt any current from coming into the computer, but your hand might slip and turn it back on, so it's safest to disconnect the cord entirely. It's also a good idea, after disconnection, to press and hold the soft power button down for a few seconds so that we drain the capacitors - think of capacitors as buckets of water with little holes in the bottom, except that they're holding electricity instead of water.

Don't take apart the power supply. It is not a field serviceable unit. It can deliver a fatal shock even while it is unplugged.

Some computer cases have sharp edges that can badly cut you. Try to avoid "forcing" things. There is usually a more finessed way. When you cut yourself, take proper care of your injuries to avoid infection.

Many cleaning solutions contain flammable and poisonous materials. Avoid getting them on your skin or in your eyes. Consult the appropriate Material Safety Data Sheet (MSDS) for information on the proper handling of these and other hazardous substances. Also note that batteries are considered hazardous waste in many jurisdictions. Consult your local government for information on how to dispose of spent batteries.

Some other materials, like the heat sink paste, can be toxic. Wash your hands after working on a computer, and don't have food in the work area.

Computer Safety

When it comes to electronics, electrostatic discharge (ESD) is a serious issue. Even static shocks that you can't actually feel can damage the delicate components that you'll find inside a computer. Damage caused by electrostatic discharge is invisible and permanent. To help prevent electrostatic discharge, wear an antistatic bracelet, and attach the

grounding clip to the frame of your computer case. Also, avoid working on carpet if you can, especially during the winter.

It is acceptable to operate the computer with the case open while testing successful installation of physical components. However, one should never touch the components inside the computer while it is running. You could damage components and/or ruin the power supply.

One of the most important parts of the computer is the CPU cooling fan. After doing anything involving it, take care to verify that the fan is in fact operational. The CPU can overheat quickly, which can cause permanent damage.

Miscellaneous

Some jurisdictions have electronics recycling programs. These help keep end-of-life electronic products out of landfills. An example is the Atlantic Canada Electronics Stewardship (ACES), operating in the Canadian provinces of Prince Edward Island and Nova Scotia. For information, visit <http://www.acestewardship.ca/>.

III. Materials List

Upgrade Components

CPUs: Intel i3 540 @ 3.06 GHz

RAM modules: Kingston ValueRAM KVR1333D3N9K2/4G (kit of 2, 2GB per module)

Motherboards: ASUS P7H55-M

Hard drives: Western Digital WD5000AAKS-22V1A0, 500 GB

Tools

Phillips #2 screwdriver

Software

Updated BIOS ROM, if necessary (see part V, section 1, pages 12-14)

Clonezilla SE available on server (see part V, section 5, pages 23-24)

Other

Notetaking implements

Antistatic bracelet

Thermal paste

IV. Physical Installation

1. Removing the old motherboard

As the motherboard will reside deep inside the case, it will be the first focus for removal and reinstallation. Naturally, there are several little things we must do before we haul out the old motherboard (see Figure 1).



Figure 1 - Ye olde motherboard

First, with the power off and the computer unplugged (and all peripherals disconnected), we need to remove the case. Typically, the case has a cover on one of its sides that is designed to be easily removed (Figure 2).



Figure 2 - Case cover designed to slide off

If you're lucky, your case cover may just have some screws that you can loosen with your fingers (Figure 3). Failing that, you'll need to find an appropriate screwdriver.



Figure 3 - Case cover screw that can be removed with one's fingers

Now we'll remove the cables from the storage devices (optical drive(s) and hard drive(s)) and set them aside. Note where each is supposed to go.

You'll see some wires leading from the front of the case to the motherboard. These kontrollieren der blinkenlights und der butens. Be especially kareful to note vere diese go, and/or be prepared to consult the manual of the new motherboard (page 1-12, "System Panel Connector"). Getting ahead of ourselves, the restored connections should look somewhat like those shown in Figure 10.

Remove the power cables, then remove the RAM and any expansion cards which may be present.

Remove the CPU fan from the CPU socket. There are sometimes special plastic fasteners that are designed to be unlocked with your fingers. When you find out what works with one fastener, apply that to the others. Gently lift the fan away from the socket so that the motherboard can ultimately be lifted out cleanly.

Now we want to remove the motherboard itself. Look carefully for the numerous screws that secure it to the case and unscrew them with a screwdriver. Set the screws aside

carefully; you may need them later. When all of the screws are out, gently remove the motherboard from the case.

2. Installing the new motherboard

Insert the new motherboard, being careful to align its built-in ports with the appropriate holes on the case. Fasten the motherboard to the case with the screws.

3. Installing the CPU

Use the zero-insertion-force (ZIF) lever to open up the socket (Figure 4) and then we insert the new CPU (Figure 5). The CPU will only slip in one way – note the notches along the outer edge of the CPU and socket. The shiny parts on the socket match up to the shiny parts on the CPU, so don't put it in upside-down.

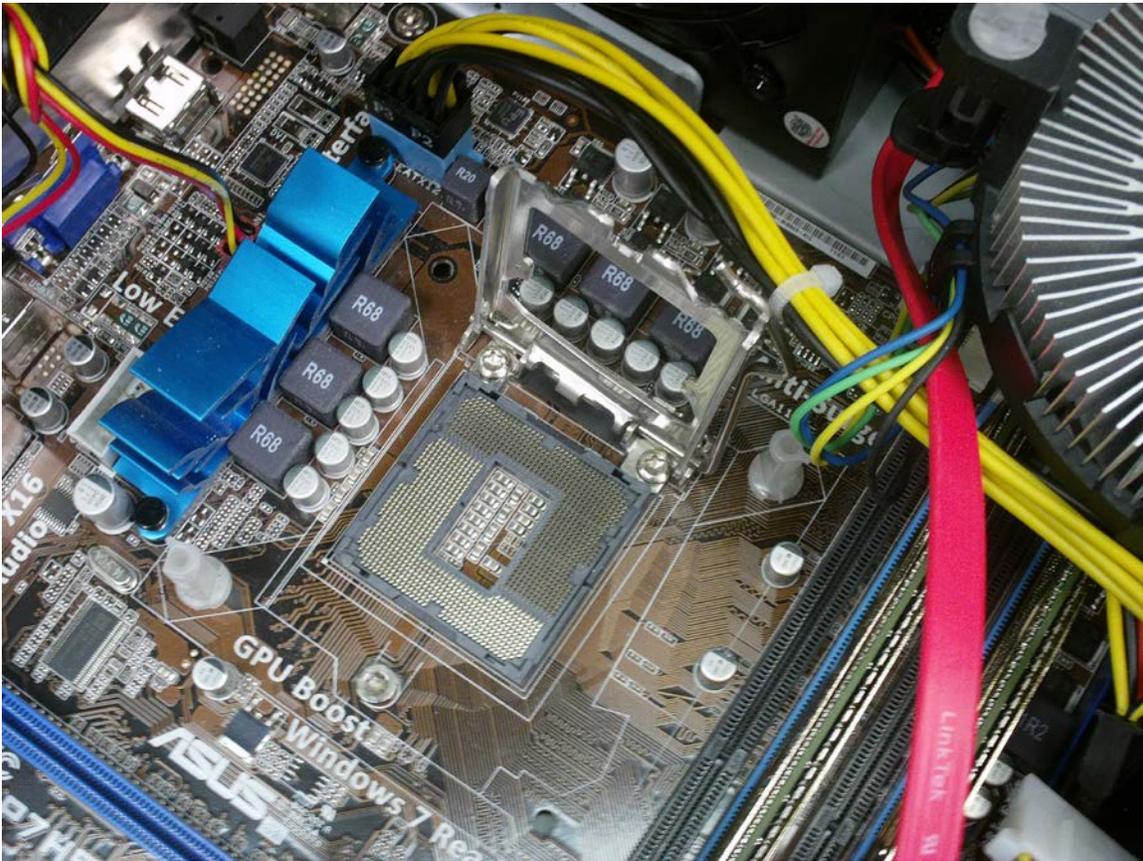


Figure 4 - Opening the CPU socket



Figure 5 - The new CPU placed in the socket; thermal paste applied

Either the top of the CPU itself or the metal plate on the cooler should have a thin layer of thermal paste. A very thin layer will do - applying too much paste will make the cooling less effective. Don't eat the paste.

Now we'll put the cooler back on top of the CPU. It's critically important that this fan is functional. If the CPU is not adequately cooled, it could overheat and become permanently damaged. You might want to leave the case off the first time you boot so that you can see that the fan is working. (Whatever you do, don't touch anything inside the computer while it's running.) If it doesn't run, ensure that the fan is receiving power (Figure 6).

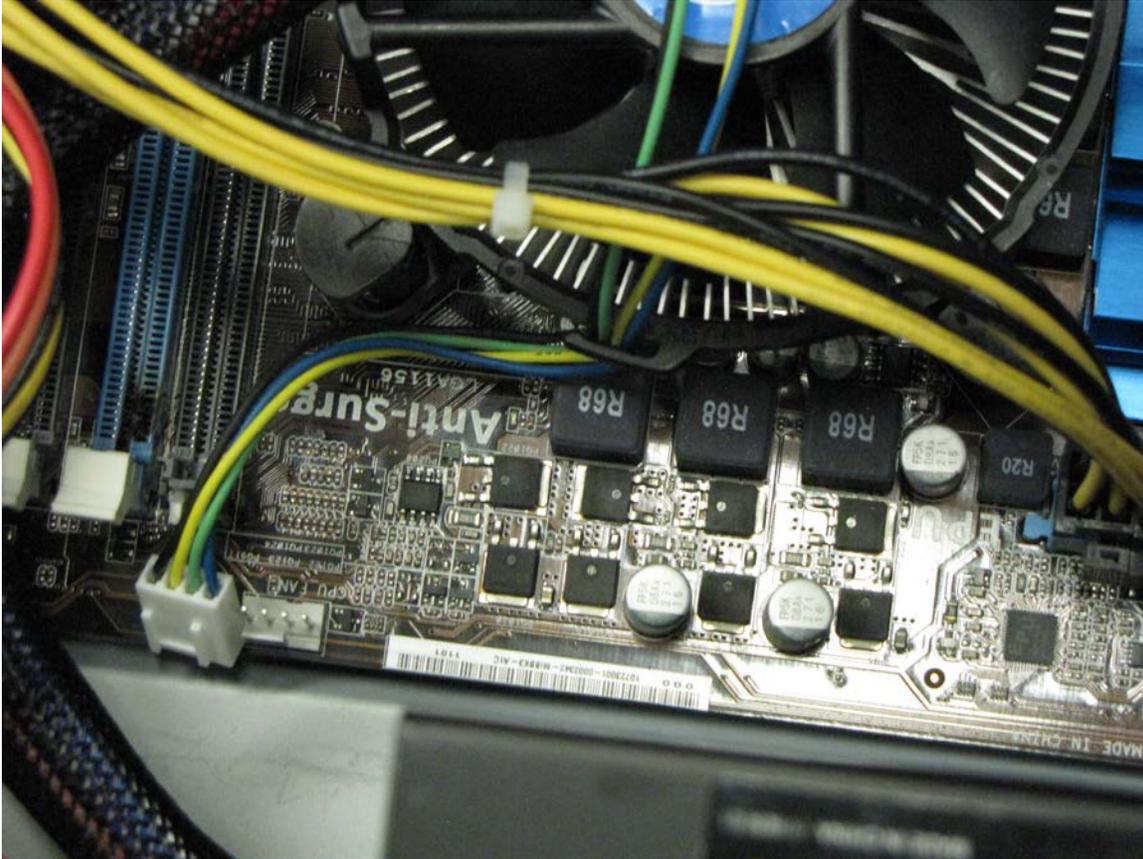


Figure 6 - Disconnected CPU cooling fan. Ensure that its power wires are connected to the motherboard (lower left)

While the system boots, you can press the delete key to get into the BIOS setup and take a look at the CPU temperature (under Power -> Hardware Monitor). You can check the CPU documentation for recommended temperature guidelines (for the Intel i3 540, the temperature inside the case should not exceed 72.6°C ¹).

4. Installing RAM

RAM modules are installed into slots like the ones shown in Figure 7.

¹ - <http://ark.intel.com/products/46473/>

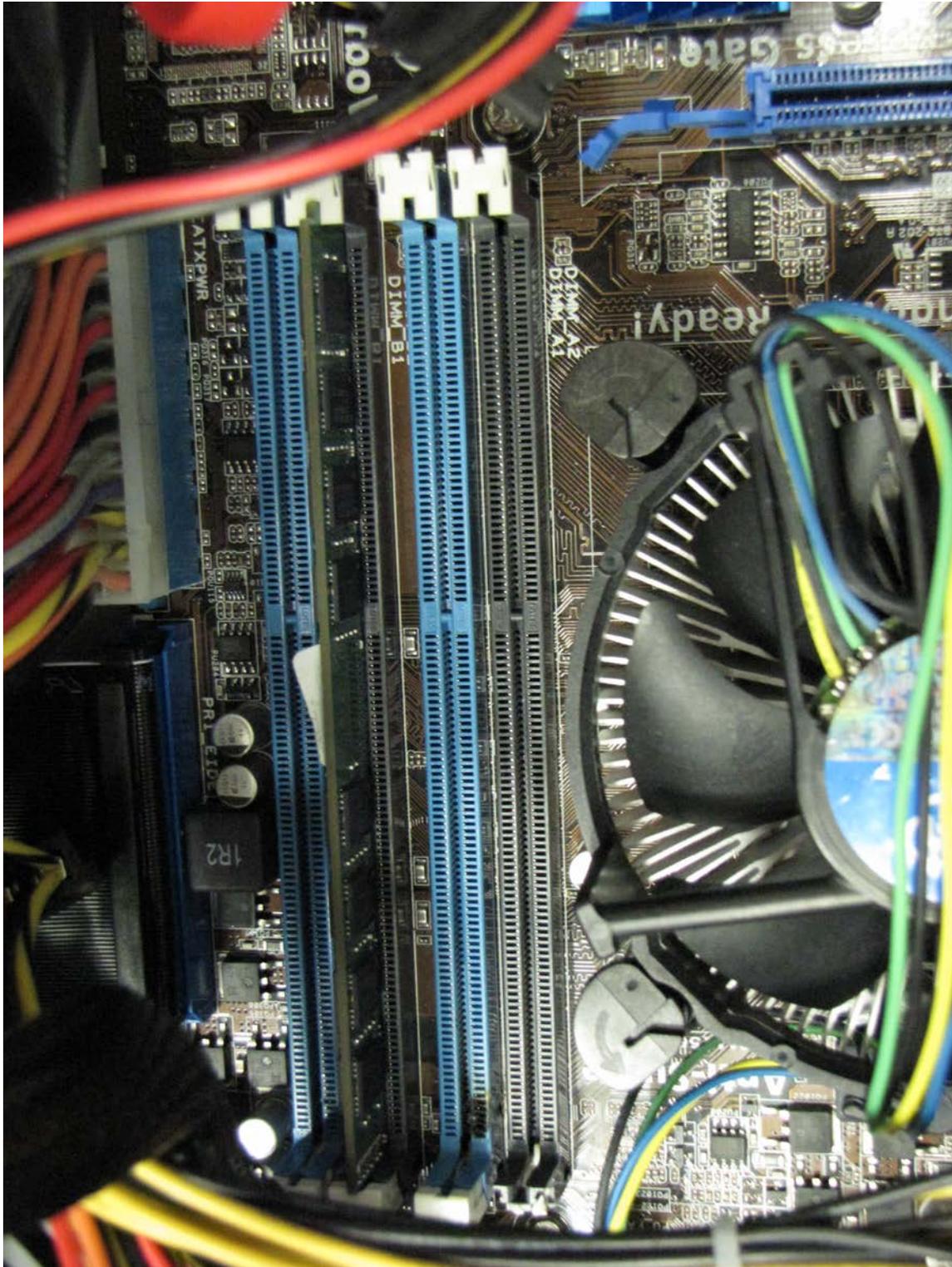


Figure 7 - RAM slots (these slots support dual channelling)

Note the blue (A1, B1) and black (A2, B2) RAM slots. This motherboard supports dual channelling, which means increased throughput to and from RAM, resulting in better

performance. If you have only one RAM module per workstation, it doesn't matter so much which slot you install in as long as the slot is in working order. But if you have two identical modules, put them in A1 and B1 (the blue slots) or A2 and B2 (the black slots). If you install one or three modules, the motherboard reverts to single-channelling. Also, if a slot looks like the slot shown in Figure 8, choose a different slot.

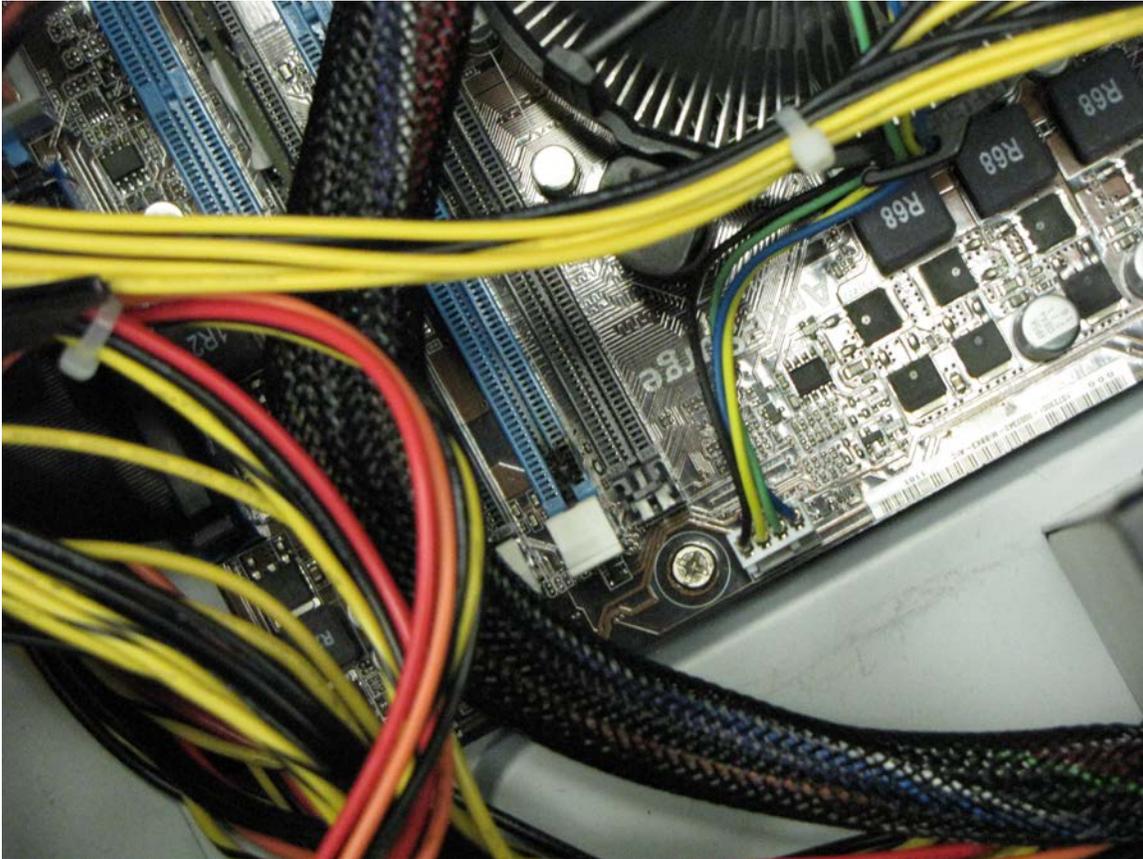


Figure 8 - Bad RAM slot (note the burn marks)

The RAM needs to be precisely positioned – push until you hear a click and make sure it is seated tightly. “Pretty close” just won’t do in this situation.

5. Installing the hard drive

The hard drive we’re installing is a SATA drive, so installation is a snap – once you slide it into an appropriate 3.5” expansion bay, merely connect a SATA cable from one of the free SATA ports on the motherboard to the SATA port on the back of the hard drive. For power, you can use *either* the SATA power or the traditional Molex 8981 connectors, but never both. To see what the connectors look like, consult Figure 9.

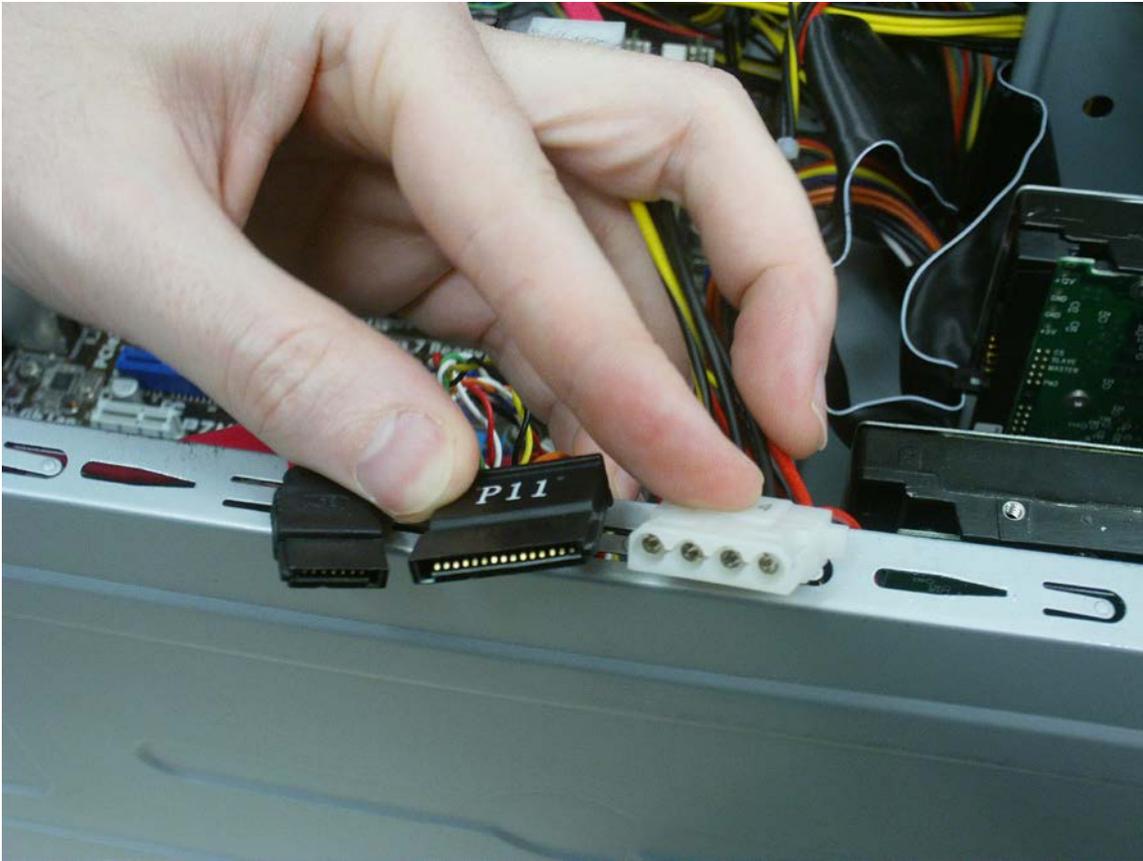


Figure 9 - Hard drive connectors, from left to right: SATA, SATA power, Molex 8981 (choose one and only one of the latter two)

6. Reconnecting the system panel lights and buttons

Remember der blinkenlights? Consulting your notes, or the manual² of the new motherboard (page 1-12, “System Panel Connector”), reconnect the system panel LEDs and buttons. The restored connections should look somewhat like those shown in Figure 10. The manual describes this configuration (viewpoint is with the connector panel being at the lower right of the motherboard):

1	2	3	4	5
6	7	8	9	0

1	Power LED +	6	HD LED +
2	Power LED -	7	HD LED -
3	Power button Power	8	Reset button Ground
4	Power button Ground	9	Reset button Reset
5	Nothing	0	Nothing

² - http://ca.asus.com/en/Motherboards/Intel_Socket_1156/P7H55M_LE/

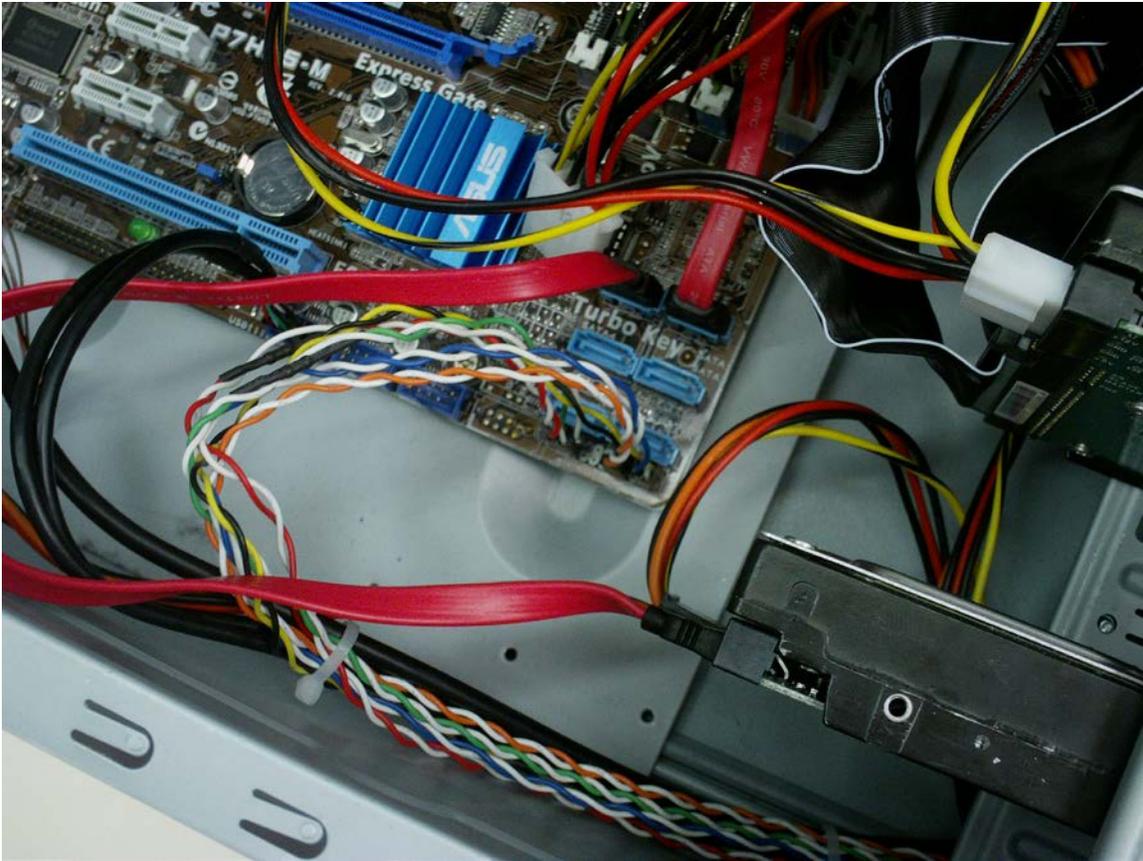


Figure 10 - System panel LED connections

7. Reconnect power cables and close the case

Lastly, restore the power connection between the power supply and the motherboard (a gigantic 20+4 pin connector that's hard, but possible, to miss), and, when you're satisfied with the hardware installation, close the case and reconnect the system to power and peripherals.

V. Software Configuration

1. Updating the BIOS

First, check and make note of your current BIOS version. To do this from Windows, type *msinfo32.exe* in the Start Menu search field and run System Information. Record the BIOS version and the date, found under "BIOS Version/Date" (see Figure 11).

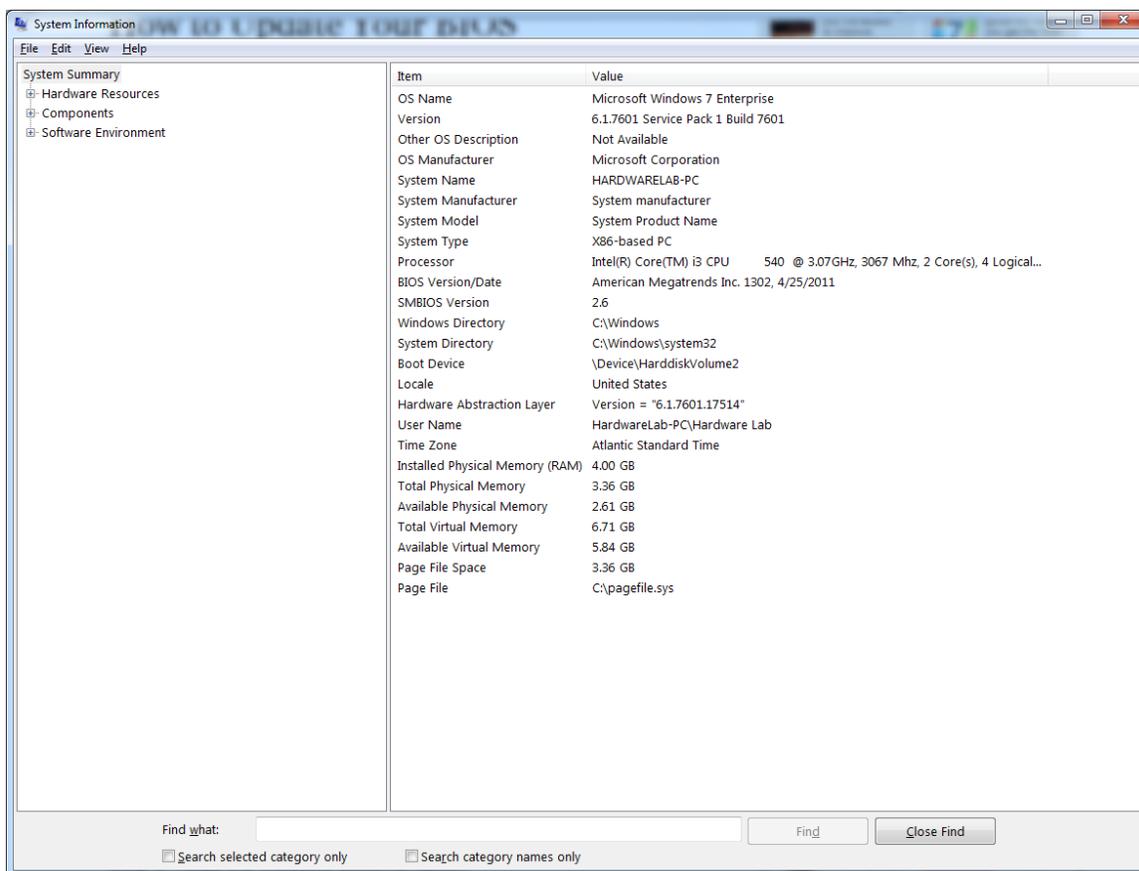


Figure 11 – The System Information (*msinfo32.exe*) window. Make note of “BIOS Version/Date”, here appearing under the processor information.

Next, go to the motherboard manufacturer’s website and search for an applicable BIOS update. Presently, we are upgrading to P7H55-M motherboards, but the easiest thing to do is to navigate to support.asus.com and enter the serial number from a motherboard of this type (available from a sticker on the box – the number may be labelled “S/N”). Select an operating system (for us, Windows 7 32-bit), select BIOS, and download the file.

The BIOS will be contained in a ZIP archive. Don’t use Windows’ built-in ZIP handling, as it is known to cause problems with the update file. Instead, use a program such as WinRAR (free to try for 40 days, and available from [CNET](http://www.cnet.com)) to extract the .ROM file from the ZIP. Extract the .ROM file to a location that is easy to reach in terms of file structure – for example, the root directory of the local hard disk. You might also consider burning the .ROM to an optical disk so that you can visit each computer with it, if multiple upgrades need to be performed. Try the upgrade on one computer first, so as to see if the upgrade file works before copying it.

To install the upgrade, reboot the computer and press Delete to enter Setup. Go to Tools, then select “ASUS EZ Flash 2”. Start the utility. Inside, press TAB to switch between the drive list and the file list. Note that the drive letters may not be the same as the ones

assigned by Windows. When you have the .ROM file highlighted, press Enter to load it. Verify that you're sure. Heed the warning not to turn off the power, as interrupting the flash can permanently ruin the BIOS.

If you receive a "no update module was found" error, the problem is related to how the .ROM file was extracted from the ZIP archive. Extract with a more robust utility such as WinRAR and try again.

2. Configuring the BIOS

Setting the clock – It's a good idea to set your system clock to local time³ before booting into your operating system, otherwise you could experience a raftload of arcane errors. The time is set on Setup's opening screen, and changes are immediate (even if you exit Setup and "discard changes", the clock will still be where you set it). To change the time, press Enter to move the cursor over h: m: and s: (hour, minute, second) and use the +/- keys to set the numbers. Do the same with m d and y (month, day, year). The day of the week is calculated automatically.

Set a supervisor password to secure the BIOS settings – This is an important step in securing the system as a whole. For example, the organization may choose not to authorize users to boot from their own devices or optical discs. We can change the boot device order (see below) to prevent this, but without a supervisor password, any user could get into the BIOS and just change it back again.

To set a supervisor password, under "Boot" select "Security" and "Change Supervisor Password". After you've set one, "User Access Level" appears. We want this to relate to what you would be able to do without a password (though optionally it is possible to set a user password as well). Note that the default is "Full Access"! That is, users can access Setup and access and change everything except the extent of their own access and the supervisor password itself. Change the setting to "No Access", which means that the supervisor password will be required to access Setup. Additionally, "Password Check" should be set to "Setup".

Enable booting from LAN (PXE boot) – The ability to boot from the LAN is not enabled by default. Under the "Advanced" menu, select "LAN Boot ROM" and enable it. Also, be sure to ensure that "Realtek LAN" is enabled, unless you're installing a discrete network interface card.

Change boot device order – Under "Boot", select "Boot Device Priority". You will probably want to set the hard drive as the first device for security reasons. But if you want to clone the systems over the LAN, select "Network: Realtek Bo"⁴ instead. Use the + and - keys to move devices up and down in the order. (When a device isn't present or

³ - Raymond Chen: "Why does Windows keep your BIOS clock on local time?" - <http://blogs.msdn.com/b/oldnewthing/archive/2004/09/02/224672.aspx>

⁴ - I believe they meant to say "Boot" but were tragically truncated.

can't be booted from, the BIOS attempts to boot from the following device until all possibilities are exhausted.)

Exit / save changes – Press F10 at any time to save changes and exit. Press Esc to exit without saving changes. For more details, see the choices under the “Exit” menu.

Clear BIOS settings from within the Setup program – Under the “Exit” menu, select “Load Setup Defaults”, then save them either by exiting and saving changes from the same menu or by pressing F10.

Clear BIOS settings through hardware – For situations where the Setup program is inaccessible, a hardware reset is possible. With the system unplugged (or, at the very least, the hard power switch on the rear of the case being turned off), remove the case and find the CMOS battery and the nearby jumper, as shown in Figure 12. There are three pins and therefore two possible positions. Move the jumper to “Clear RTC” (that is, have it on the two pins closest to the battery) for 5-10 seconds, then return the jumper to “normal” (back to the two pins farthest from the battery). If you did not unplug the system or turn off the hard power switch, the computer will suddenly spring back to life. If your supervisor is in the room, try to make it look like you meant to do that.

Other than for clearing the settings, don't remove the jumper from its normal position. Its absence will cause system boot failure.

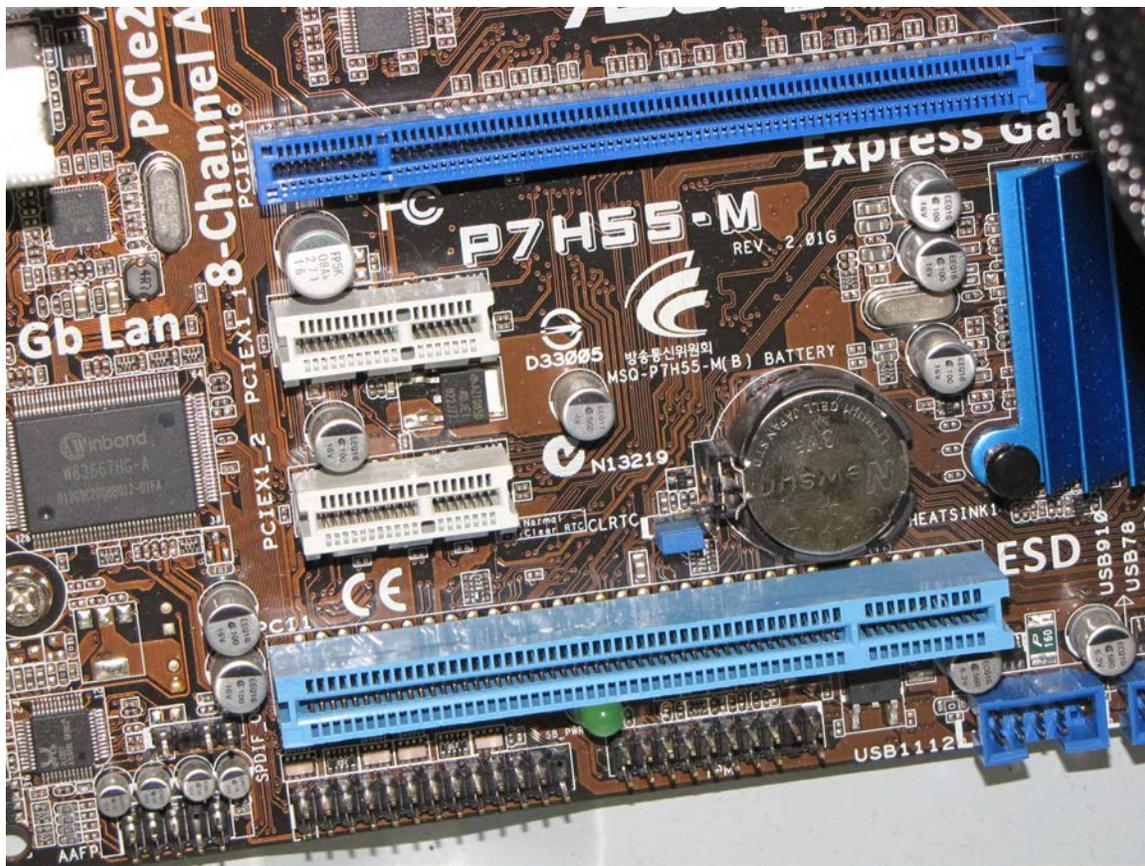


Figure 12 - The CMOS battery and the settings jumpers (to its lower left)

3. Setting up and using Windows Update

Windows Update no longer relies on Internet Explorer and is now its own independent component. In the Start Menu, select “All Programs” and then “Windows Update”. You should be presented with a screen that looks like the one shown in Figure 13.

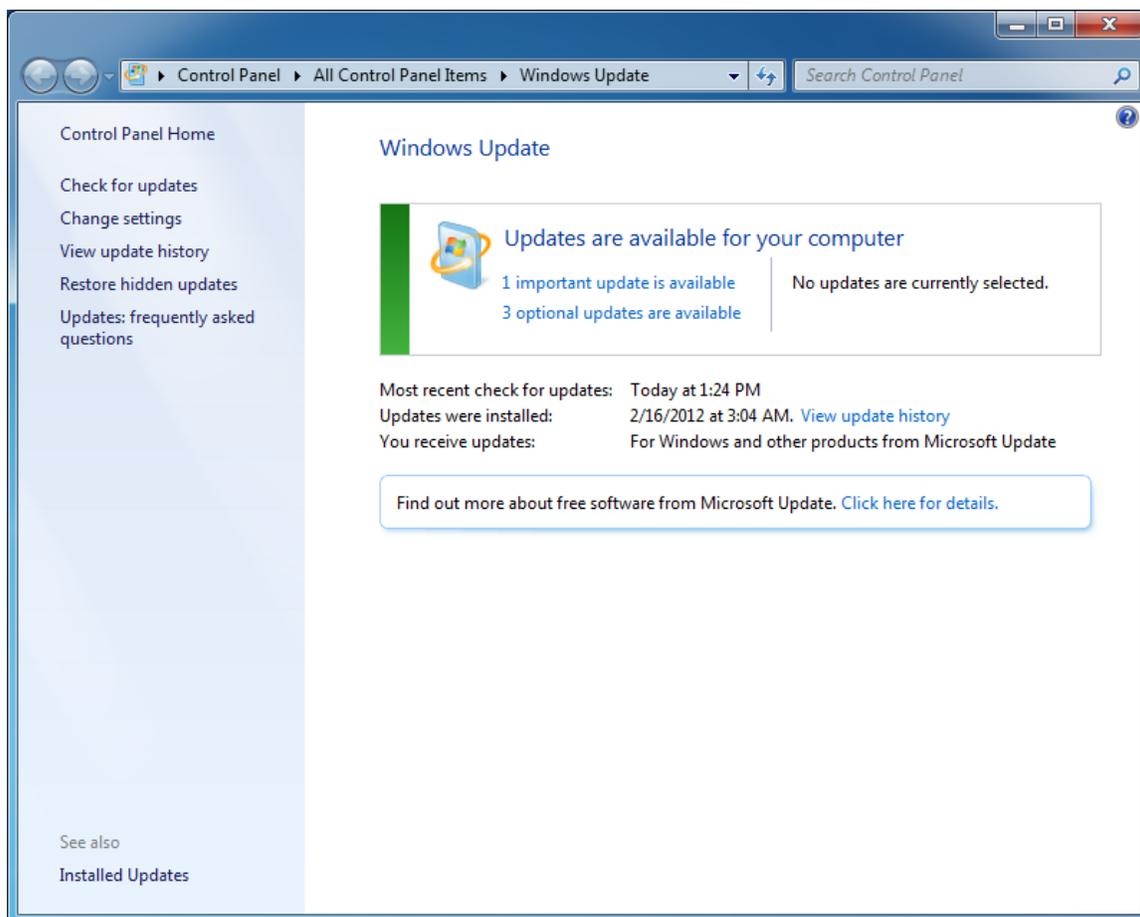


Figure 13 – Windows Update start screen. Select “Check for updates” in the left sidebar to make sure the update list itself is up-to-date.

Select “Check for updates” in the left sidebar to make sure that the system is aware of all available updates. To install the updates, select either the important or optional updates, and you will be taken to a screen like the one shown in Figure 14. Select all desired important and/or optional updates, then press OK. You’ll be returned to the home screen, where you can select “Install updates”, which will do just that.

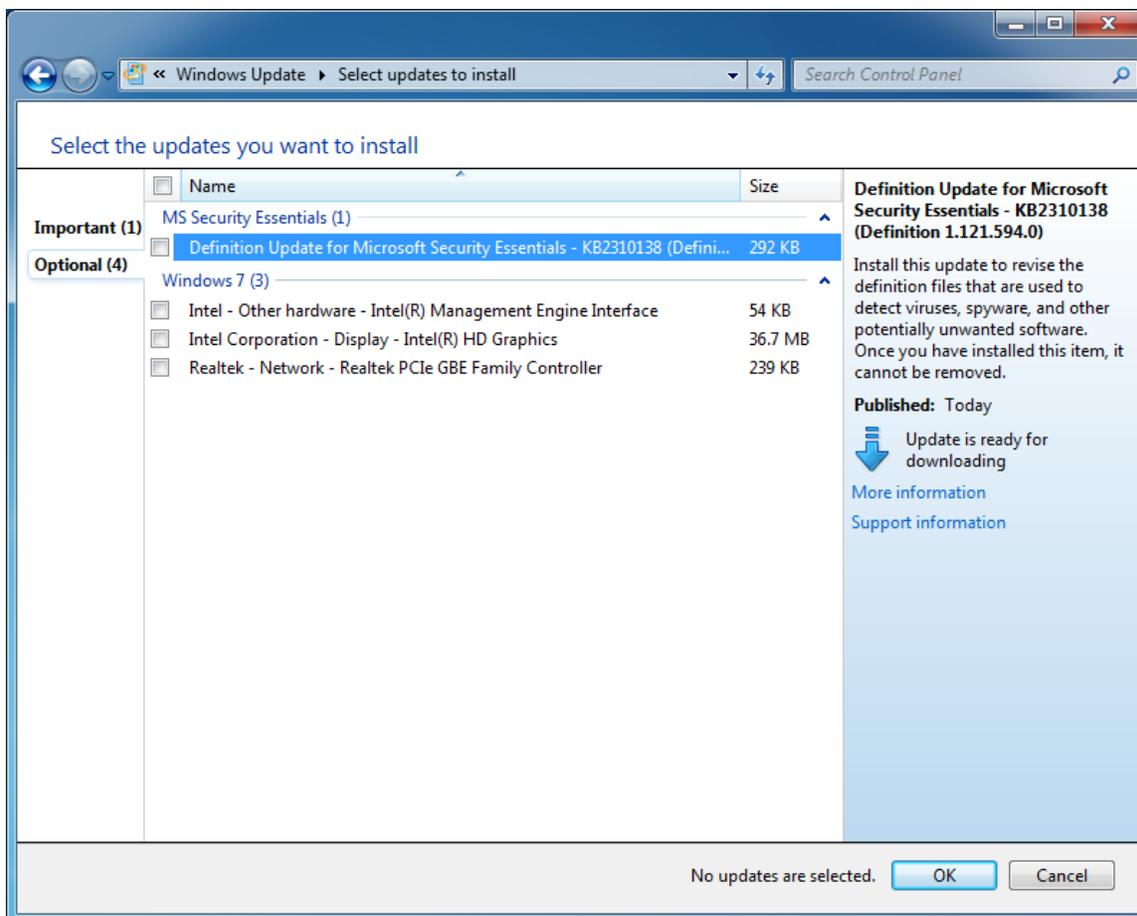


Figure 14 – Windows Update update selection screen. Check off the box next to “Name” to select / deselect all important or optional updates at once.

To ensure that future updates are automatic, click “Change settings” on the left sidebar. As shown in Figure 15, set the drop-down box to “Install updates automatically” and set a frequency. 2:00am is fine provided the computers are left on overnight. Consult with your local system administrator for an appropriate setting.

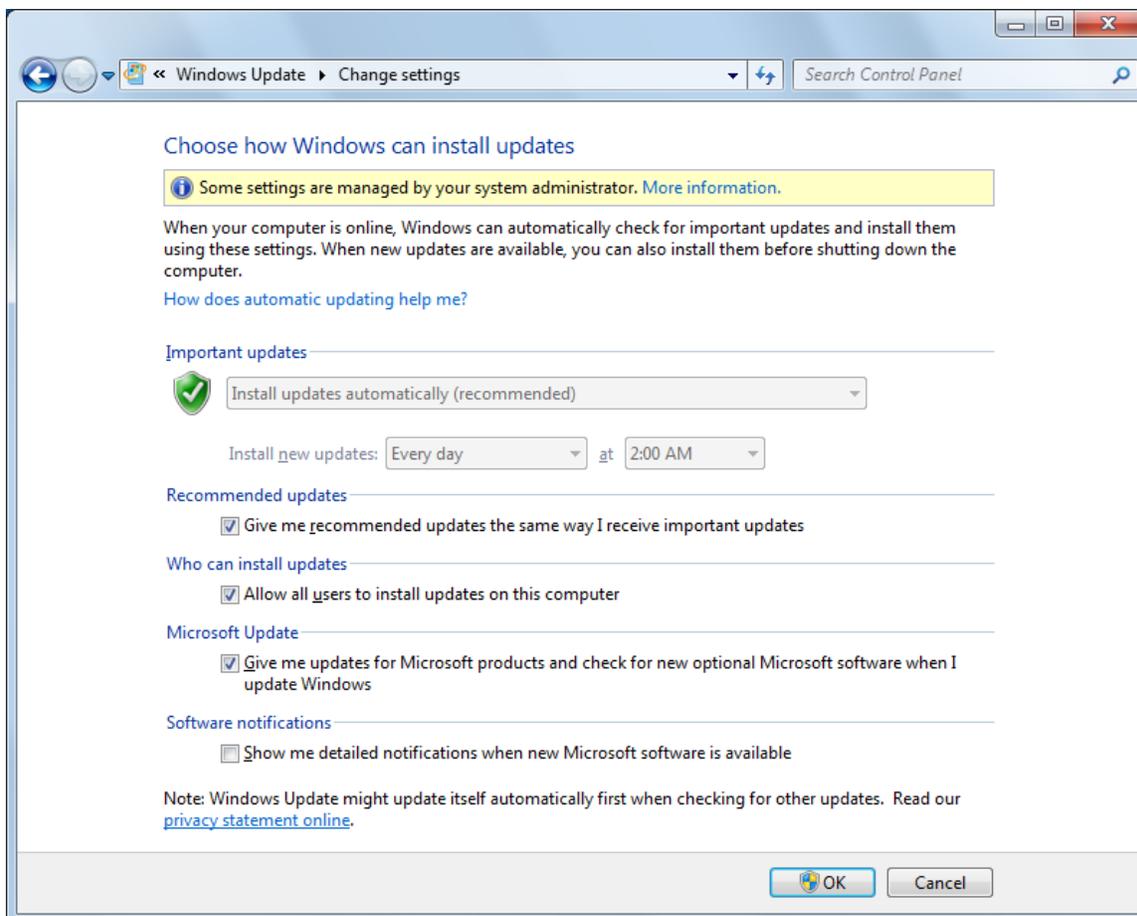


Figure 15 - Setting automatic updates and their frequency

4. Updating Drivers

Updating the drivers must be done on a component-by-component basis, however Windows' Device Manager makes it easy. First, find Device Manager in Window's Control Panel (Figure 16). Then find the component for which you want to update drivers – right click on it and select “Update Driver Software...” (Figure 17). At the fork shown in Figure 18, you can choose to search automatically for updated software (recommended unless you have a specific reason not to do so, in which case you can choose to browse the computer) and if an update is available, it will be installed. Changes will take effect when you restart the computer, as shown in the confirmation screen (Figure 19).

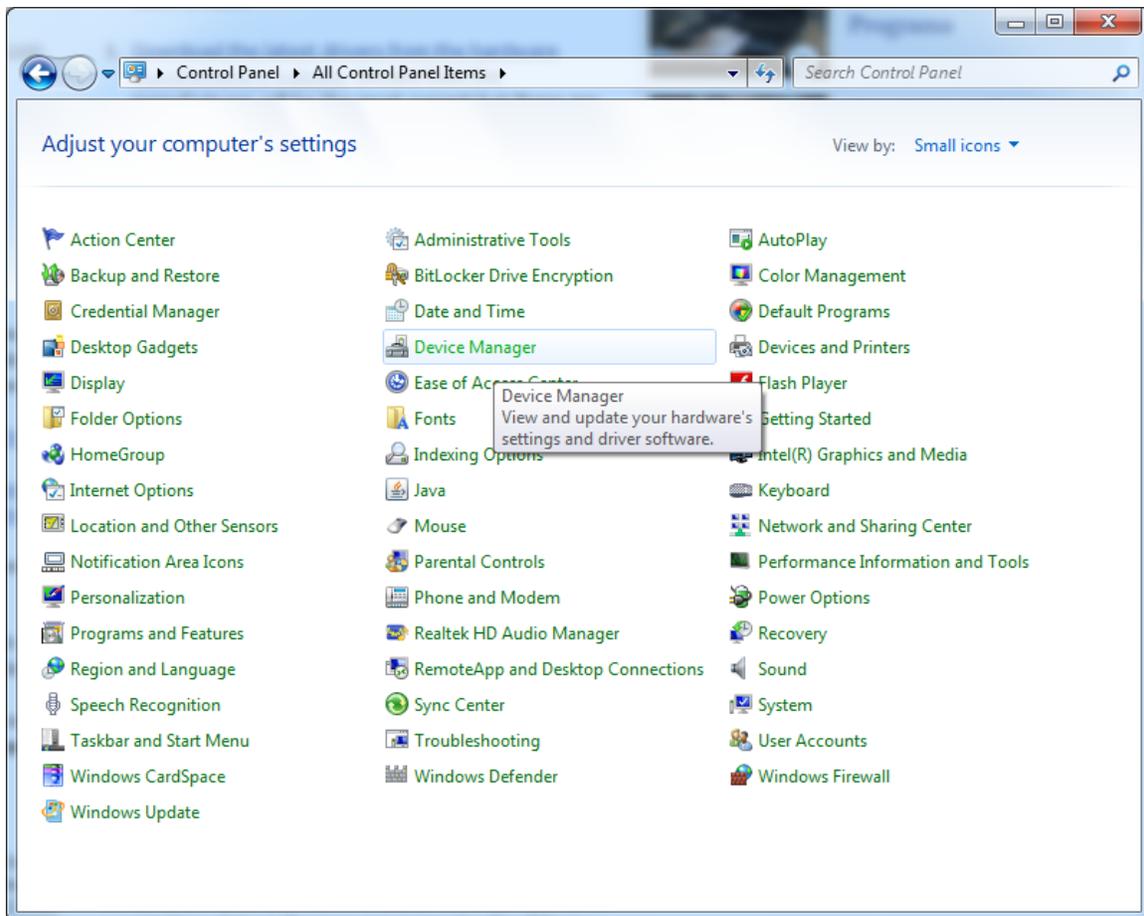


Figure 16 - Finding Device Manager in Control Panel

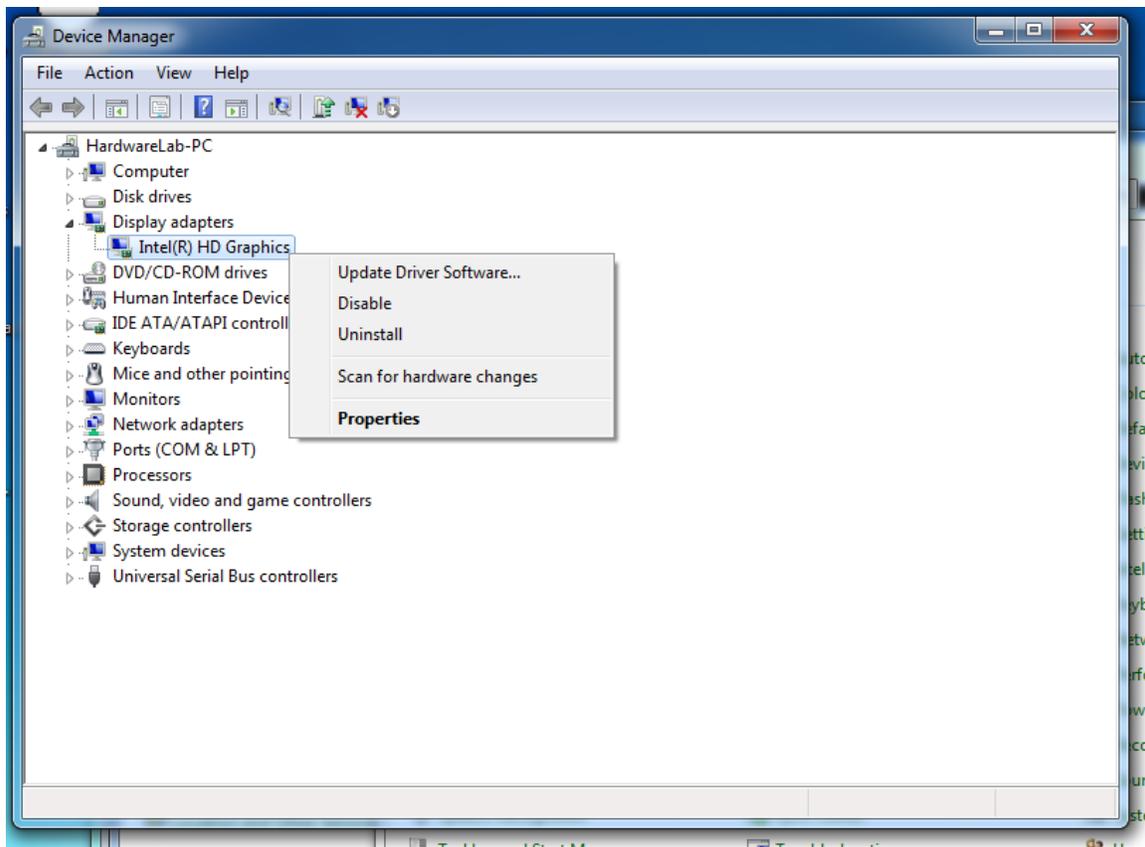


Figure 17 - Update the driver software for a device

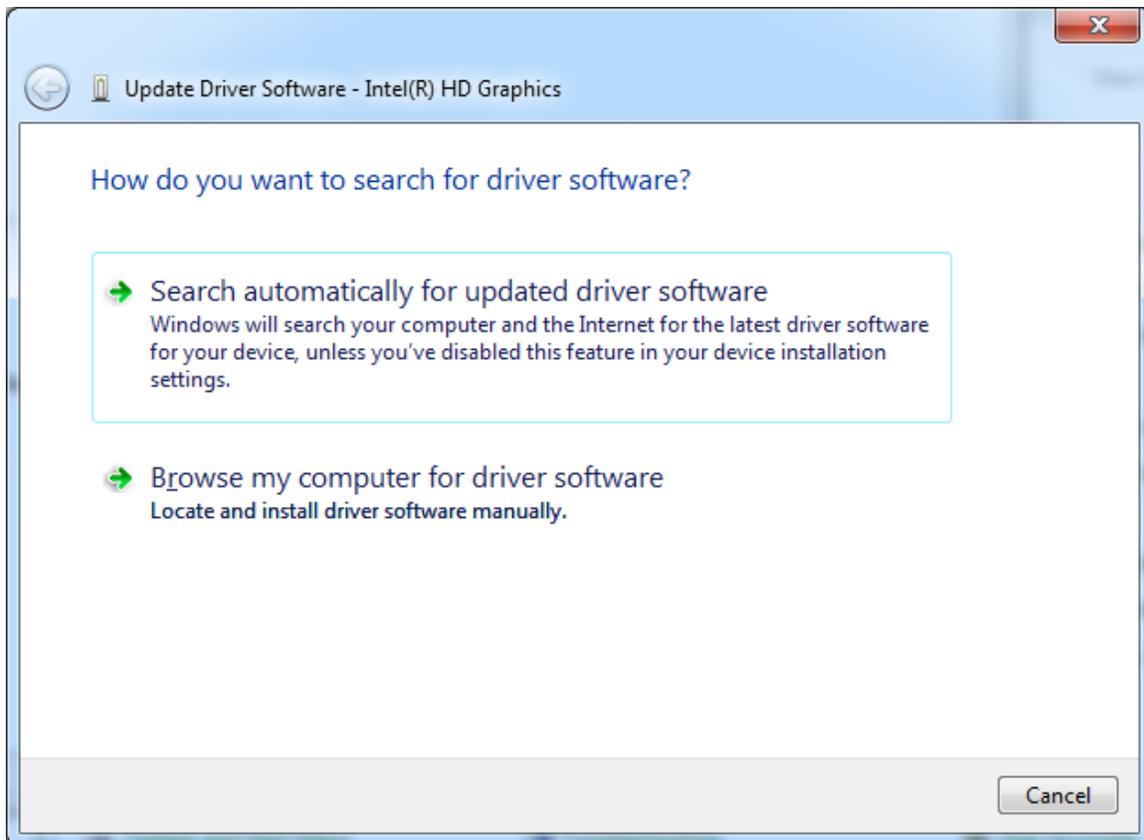


Figure 18 - Searching for driver software

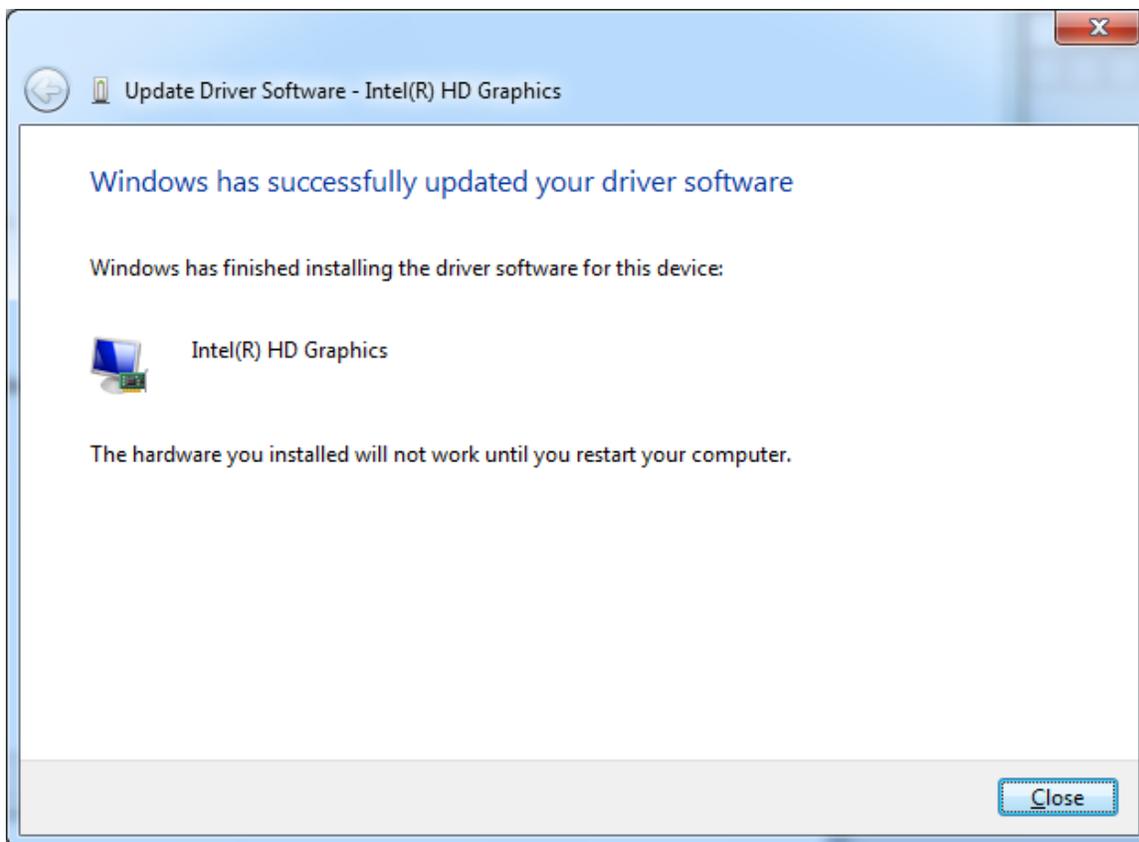


Figure 19 - Confirmation that the new driver is installed

5. Copying the image of one workstation to other computers

Once an exemplar computer has been configured, its image can be deployed throughout a network by means of free tools such as Clonezilla SE (server edition). Instructions for configuring the server and the software required can be found at clonezilla.org/clonezilla-SE.php. Setting up a DRBL (diskless remote boot in Linux) server is required – information can be found at drbl.sourceforge.net. (We'll have the server set up in advance.)

When the DRBL server with Clonezilla SE is ready, follow the steps below to distribute the image. These steps are based on instructions available at clonezilla.org.

1. Set the Clonezilla server to be in clonezilla-save-disk mode: On the Clonezilla server, run `/opt/drbl/sbin/dcs`, then choose “clonezilla-start” (use the space key to mark it). Next, choose “clonezilla-save-disk” (use space key to mark it).
2. Turn on the exemplar computer, and set it to PXE boot in its BIOS (see instructions on [page] under “Completing the BIOS”).
3. When the exemplar computer finishes its network boot, if you do not enter image and device name when running `/opt/drbl/sbin/dcs -> clonezilla-start -> clonezilla-save-disk`, a

prompt will ask you to name the image and choose the device. Now enter the name (e.g. “exemplar”) and then choose the disk you want to save it to. Otherwise, it will use the image and device name you already inputted in the Clonezilla server to save the image.

4. Once the image is saved, set the mode to be clonezilla-restore-disk in the Clonezilla server. As an example, in the Clonezilla server, run “/opt/drbl/sbin/dcs”. Next, choose “clonezilla-start” (use space key to mark it). Next, choose “clonezilla-restore-disk” (use space key to mark it).

5. The program will ask you which source image to restore. Choose the image “exemplar”.

6. Make sure the clients (i.e. the computers to be cloned to) will boot from the network, then turn them on to let them boot from network.

7. The clients will begin to clone the system image “exemplar” to their harddisks.

8. Once all clients finish cloning, you can stop Clonezilla through /opt/drbl/sbin/dcs -> clonezilla-stop.

VI. Troubleshooting

ZIF lever won't close

The CPU will only fit one way into the socket. It's evident enough that the shiny conductive bits on the CPU and on the socket are meant to face each other, but the small notches around the edges of the CPU and socket are easy to miss. Ensure that they are lined up and attempt to close the lever again.

BIOS upgrading – “No Update Module Was Found”

This problem relates to how the .ROM file was extracted from the ZIP archive provided by Asus. Use a robust program such as WinRAR (free to try for 40 days, and available from [CNET](#)) to extract the .ROM file from the ZIP and try the upgrade again.

Blank screen and beeping at power-up after installing motherboard or memory

A repeating series of “long short short” beeps indicates a video problem. Since this configuration does not include a discrete video card, the video memory is shared with the standard RAM. If the RAM is seated improperly (or in a malfunctioning slot), the motherboard will be unable to output to the monitor, hence the video warning for a memory issue. Solve this problem by re-seating the RAM. See pages 8-10 for more details.

The system will not boot from the LAN / won't connect with the Clonezilla server

Booting from LAN is not enabled by default. See the section on BIOS configuration, pages 14-15, for details on enabling the LAN boot and moving it to the top of the boot device ordering.

“CMOS Date/Time Not Set / Please enter Setup to recover BIOS setting”

The CMOS battery may be missing or failing. It is a 3V CR2032 lithium battery that typically lasts for many years; however, its lifespan is finite. With the system turned off and unplugged, try replacing the old battery with a fresh battery. See Figure 12 for a picture of the battery. If the battery is the issue, dispose of it safely (see pages 1 and 2).

If you wish to boot into Windows or use the system with a bad or no battery, you may do so – but to avoid a multitude of arcane errors, it's best to set the clock in the BIOS setup first. (See page 14 for details.) An approximate time will suffice – you can precisely synchronize your system clock later using time servers on the Internet.

CPU Fan Error

If you see this when starting the computer, turn it off right away. After unplugging it, check that the CPU fan is connected to the motherboard. A disconnected CPU fan cord is shown in Figure 6. Operating without a working cooling fan will damage the CPU.