

Turbo Boost *your PC*

**Benchmarking and
Overclocking in Linux**



Are you ready to raise the bar? Ready to witness a performance from your PC that you'd not seen in years? Then tighten your seat belt, grab a chilled drink and get ready to exhaust the tower with the monstrous benchmarks!

Most PCs today—i.e., if you own a processor like the AMD Athlon (90/65nm) or Core 2 Duo and above—come with decent headroom to increase performance. The question is: have you ever considered pushing the limits?

If so, tighten your seat belt, because in this article we will not only learn about torturing the hardware, but also unravel the facts about overclocking your hardware and the status of benchmarking in Linux.



Note: Overclocking is raising the clock speed of the processor from the factory settings. Benchmarking, on the other hand, is an assessment test to measure the capacity of the hardware at your disposal.

Some of you must be mulling over what Linux has to do with overclocking? Well, yes, the operating system has very little to do with overclocking. But when you pump up the speed of your system, then various things need to be considered. The operating system chips in by offering various monitoring tools and other requisites.

Note that this tutorial will only guide you with the basics of overclocking. Since it's a very vast topic, and the overclocking options vary from motherboard to motherboard and the BIOSs they come with, more details are out of scope of this article.



Statutory warning: Overclocking is fun to begin with, but reckless decisions can bring your whole system down. The author and the publisher will not be responsible for any damage caused, and what's worse is that afterwards, you will not be covered by the product warranty either. So, you'll need to remember one thing—slow and steady wins the race.

The only precautionary measure is not to take hasty decisions—stay calm, and nothing will go wrong. The fact is, overclocking is highly addictive, so beware and don't let your excitement overtake you. Because once you get overexcited, you will surely end up doing something wrong.

Now that we're done with the warnings and introductory notes, let's move on. Overclocking requires a few tools and utilities as well. But for what, you may ask? As I mentioned earlier, overclocking needs to be done through the BIOS. Yes, the best and rudimentary way to overclock is from BIOS. However, once you have overclocked the system, there are several factors that need to be dealt with.

The most important is the temperature. Temperature plays a vital role in the life of silicon. All the diodes/chips/processors are made using silicon, so the temperature must be kept under control. We will get to know more about it later. But before that we need some software to monitor certain things for us.

Unfortunately, the software potpourri isn't as diverse as that of Windows, but still, there is a decent amount of benchmarking and monitoring software available for Linux. In this article we will take a look at the following:

1. **Hardinfo:** A one-stop shop for all the monitoring utilities in Linux
2. **Phoronix Text Suite:** Undoubtedly, a vast and the most popular benchmarking suite for Linux
3. **Geekbench:** Another cross-platform benching program
4. **Prime95B:** A CPU stress-testing program

The test set-up used for overclocking and benchmarking is described below:

- AMD Phenom II Dual Core X2 550 Black Edition processor (unlocked to Phenom II Quad Core X4 B50), with 45nm fabrication and socket AM3
- Jetway Ha07 790GX AM2+ motherboard
- Transcend DDR2 800 MHz 4GB kit @ 5-5-5-15/dual channel
- Western Digital 640AAKS Blue Edition hard disk drive
- Prolimatech Megahalems + Scythe Sflex 120mm 75cfm fan (CPU heat sink and fan)
- Corsair VX450 SMPS | open air system
- Operating systems: Ubuntu 9.04 64-bit and Mandriva 2009.1 32-bit

Benchmarking your PC

Before we get started, we should know about the types of benchmarking. There are many benchmarking applications and methods to test the system. These are generally segregated into the following two categories:

1. **Real-world benchmarking:** All benchmarking of real tests such as FPS (frames per second) in games, the time to compile software/the kernel, the encoding/decoding time of media files, etc, fall under this category. This is perhaps a more practical way to judge a PC's calibre. Most benchmarking software don't cater to real-world benchmarking; thus, these tests are done by using the computer on a daily basis.
2. **Synthetic benchmarking:** All software and tests designed to appraise the system potential are termed as synthetic benchmarking software. These are good to obtain quick results, and one doesn't need to waste much time running tests, one by one. However, some of the software tends to favour certain brands and products. For example, the Super PI test favours Intel processors while the AES benchmarking favours AMD processors. Thus, these are not always the premier solution to judge a PC's potential.

Hardinfo

Sleuth tools let you obtain crucial information about your hardware. These tools not only provide valuable information but also prove to be viable alternatives to digital multimeters and power calculators. Unfortunately, there aren't many alternatives available on the Linux platform, and this is where Hardinfo chips in to provide the perfect

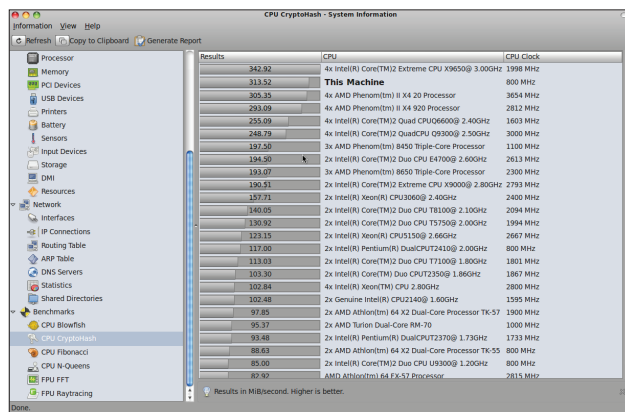


Figure 1: Hardinfo Benchmark

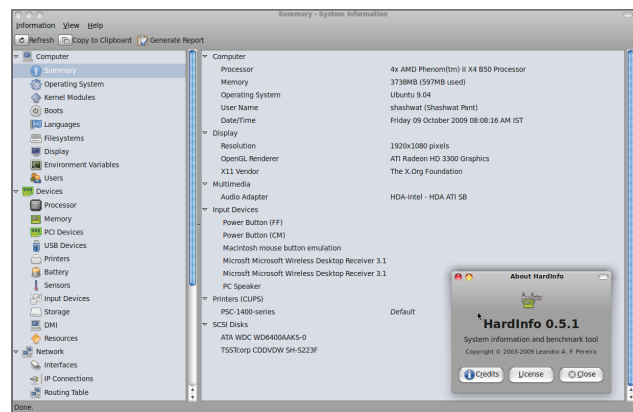


Figure 2: Hardinfo Default Looks

blend between a hardware listing and a decent benchmarking tool.

Hardinfo [<http://hardinfo.berlios.de/HomePage>] delivers precise details about the hardware installed and the connected devices atop an easy-to-use GUI. The website claims that the tool "...can gather information about your system's hardware and operating system, perform benchmarks, and generate printable reports either in HTML or in plain text formats."

The app's interface is segregated into two columns. The left column serves as the navigation bar that consists of a plethora of hardware categories, which are further divided into relevant entries. The section on the right side is the overview panel that displays some information about the entries you select from the navigation panel. When you select an entry, a new panel is created to show detailed information about the selected item.

Apart from its hardware listing capabilities, Hardinfo provides a handful of benchmarking tests to put your system through rigorous exercises. The default installation doesn't come with much data on the benchmarking front to compare your system with other hardware. However, you can easily sync with the online database (click *Information*→*Network Updater*). Updating the database adds the data of the computers that have been tested.

Sharing data online and then syncing the software is really a great idea and lets you easily compare

your system's potential with others. I advise you to sync the system with the online service, once. This not only increases the size of the hardware database, but is beneficial for others as well. Hardinfo also provides a Report Generator. This handy plug-in allows you to generate system information along with benchmarking results, either in HTML or plain test format.

This information about the system will provide a verbose report covering the X server, the Linux distribution, hot-swappable devices, network information and lots more. It even displays the temperature using the system diode; however, I found that to be faulty—my motherboard LED indicator displayed a significantly lower temperature than that of Hardinfo.

Nevertheless, there are still many things missing from the elusive Hardinfo. Shortcomings include the missing voltage meter, dynamic speed reader, and many more. A dearth of these components is surely a big setback for any hardware listing tool,

and without these tools one cannot make proper judgements while overclocking.

The Phoronix Test Suite

Phoronix Media, one of the most popular and reliable sources for Linux news and reviews, presented the first benchmarking test suite—the Phoronix Test Suite (PTS). Phoronix regularly publishes hardware/Linux benchmarking reviews using PTS, which throw some light on what PTS is capable of doing. Initially restricted to the CLI, PTS goes through massive transitions from release to release. It has now jumped onto the GUI bandwagon, loaded with an easy-to-use GUI. It comes with support for almost all distributions and is available in the repositories of many distributions.

Id say Phoronix takes benchmarking to a whole new level, being the only one of its kind that provides users the option of 'live benchmarking' (thanks to the availability of an Ubuntu-based live

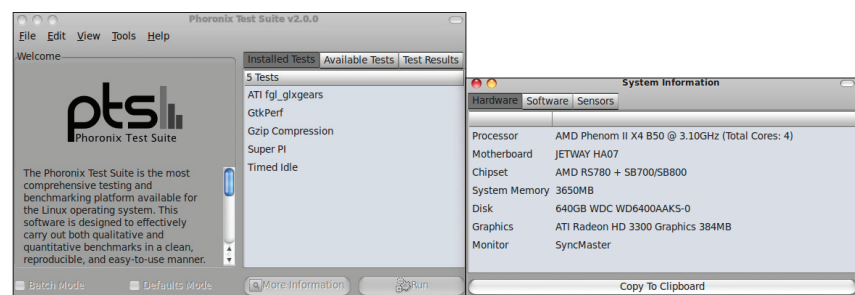


Figure 3: PTS System Overview

DVD). So all you need is a system with a DVD drive to enjoy the test suite.

Installing it is very easy and you can do so by using your system repositories or the executables provided at the project website. PTS actually acts as a wrapper for many open source/proprietary software that are available off-the-shelf.

By default, PTS doesn't come with a single benchmarking utility installed; rather, it provides an option to install them the way you want. In order to get the most out of PTS, you have to install the tests, one by one. Some tests are as huge as 700 MB, and thus installation can be a bother. It would be much better if Phoronix additionally allowed users to install multiple tests in a single click, with options like 'Tests for Processors', 'Tests for the GPU', and so on. The pack must consist of a handful of relevant tests that fall under the particular category the user is interested in.

Phoronix allows users to easily upload their results to Phoronix Global. This is a portal where you can view your results (the same way you view them offline), and from where you can make comparisons with others. In fact, the application itself prompts you to compare the result with the tests that Phoronix developers have uploaded. A very nice approach that does away with the hassle of searching for the test results to compare with your outcome.

Phoronix also provides a small system 'overviewer' that keeps you informed about hardware, software and sensors. Things are very neatly arranged in their proper categories. It even allows you to copy all the data to clipboards and then share them easily. However, in my case, it failed to detect the IGP (on-board graphics) speed. The system memory usage data was displayed incorrectly as well.

The downside of PTS is that there is no notification whatsoever while installing and running tests. Once you initiate the process, the PTS window will vanish and the user has no idea of what's happening in the background. Even though it was mentioned that support with Ubuntu notification has been added, it didn't work in Ubuntu 9.04 64-bit. Instead, a simple status message on the PTS window should have sufficed.

Geekbench

Geekbench is another efficient benchmarking software for Linux. Despite claiming to be cross-platform software, it only provides a GUI for Windows and Mac, leaving Linux

with a CLI offering. Nonetheless, the application offers a complete benchmarking solution capable of wrenching the most out of your CPU and memory.

The Linux version is an easy to execute binary file that runs from the terminal. After executing it, the benchmarking will commence and automatically complete all the tests. In the end, it will ask you to submit the data, online. If you have a working Internet connection, you can easily submit the data and add it to your profile (if you have an account). Pretty nifty indeed!

The online score browser displays scores in coloured charts—this is where you can compare your scores as well. Unlike other benchmarking software, this one gives an overall score to the system providing a rough idea of what the system is capable of.

Compared to the other two benchmarking utilities mentioned, Geekbench is not an open source application, although the developers have open sourced the detection engine (geekinfo) under the MIT licence. The detection engine seems to be flaky—it fails to detect my motherboard manufacturer and model. Apart from that, it failed to even detect the operating system used. It only showed the kernel under use instead of the distro. Since Geekbench developers want you to buy the software, they have restricted the availability of the 64-bit executable.

One of the biggest drawbacks was the overall inconsistency in scores. I tested Geekbench in all the supported OSs, namely OSX, Windows and several distributions, keeping the hardware intact across every OS. Initially developed for Mac OS, Geekbench still favours that OS by delivering the highest scores on it. The claims of providing an OS-neutral benchmarking engine seem hollow, and the statements are contradictory to the scores.

Benefits of benchmarking

Many of you must be muttering about all this information on benchmarking. Why waste resources? Why go through such trouble and waste time just for a few numbers? Well, because benchmarking is the easiest way to gauge your system. Today, all system components—be it the CPU, memory, hard drive, graphics adapters, power supply, etc—are thoroughly benchmarked and tested, and then, accordingly, manufacturers rank them by price and performance.

Benchmarking creates a sense of judgement among users. It keeps you updated about the potential of

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Jargon Buster

- **Clock speed:** This is the speed at which your processor runs under factory settings, and is calculated in Gigahertz (GHz) or Megahertz (MHz). The clock speed is generally obtained from the product of FSB/HTT/BCLK and CPU multiplier. Note that whether it's FSB, HTT or BCLK depends on the type of processor you own.
- **FSB (Front Side Bus):** This acts as a main bus speed for the processor, RAM, northbridge and southbridge. The FSB lies in the motherboard and has a memory controller alongside it.
- **HTT (Hyper Transport Technology):** This is the new generation of FSBs that are used by AMD processors. HTT is nothing but the FSB, excluding a memory controller. In AMD processors, the memory controller lies inside the processor, and that provides more flexibility throughout; as a result, AMD processors support multiple memory types. For example, Phenom II, Athlon II and Sempron 140 (i.e., the 45nm series of AMD processors) have multiple memory controllers within, allowing them to use either DDR2 or DDR3 at a time.
- **BCLK (Base Clock):** This is a refined FSB that has been developed for Intel processors and debuted with the Core i7 series of processors. The BCLK is nothing but AMD's HTT. The processor comes with the memory controller. Previously, all Intel processors—Pentium, Core2Duo, or Core2Quad—had the FSB, which limited their memory handling capabilities. With Core i7, Intel has now a memory controller merged within the CPU itself and with triple channel support providing humongous bandwidth.
- **CPU multiplier:** As mentioned earlier, this value when multiplied with the FSB/HTT/BCLK, gives the processor's clock speed. And since the Special Edition processors have the multiplier unlocked, they allow processor overclocking. Thus, you don't have to tinker with the FSB/HTT/BCLK if you have a Special Edition processor. However, you are even free to take the FSB/HTT/BCLK route if you want.
- **Integrated memory controller:** This determines the speed, type, channel and the amount of memory that can be installed in the system. With new processors, the memory controller is now merged into the processor. As a result, you don't have to change the processor in order to utilise newer and faster memory, if supported. For example, the new 45nm Phenom II from AMD comes with a dual memory controller allowing you to use either DDR2 or DDR3. So you can put the processor in an AM2+ board and use DDR2, or in an AM3 board to use DDR3. This gives a wide spectrum of options to users either to opt for the high-performance DDR3 or the value for money DDR2. As a result of multi-channel memory, motherboard manufacturers release hybrid boards with both DDR2 and DDR3 slots. So all you need to do is buy one board and RAM of your choice. If, in future, you want to make the transition from DDR2 to DDR3, then you don't have to buy a new motherboard. This contrasts with processors like Intel Core2Duo or the Pentium series, which had the memory controller on board. Thus, in order to get a higher performance RAM, you need to change the motherboard, which adds to costs.
- **CPU core voltage (VCORE):** In order to gain a stable clock speed (which works 24x7 under a full load, without any problem) we need to increase the voltage applied to the processor. By applying more voltage, we give more power to operate. More power generates more heat, and thus we must opt for a good after-market CPU cooler if you are aiming for higher clocks.
- **Memory speed:** Once you overclock your system by tinkering with the FSB, HTT, or BCLK, you substantially overclock other components as well. All the other components like memory, northbridge and southbridge, thrive on FSB, HTT or BCLK for their own clock speeds. So once you change the relevant BUS, you overclock the whole system. Memory is affected as well. Memory speed is determined by the product of FSB/HTT/BCLK and the memory multiplier. Note that just like the CPU multiplier, memory too has its own multiplier.

your hardware. You can check benchmarking journals to keep yourself updated with all the reviews of the new hardware flowing into the market. Whatever said and done, it is a perfect option to test your hardware.

Amplify speed by overclocking hardware

Overclocking is like losing weight—the initial results come very fast, but the last pounds (read MHz) take some real effort.

Almost all the hardware components can be overclocked. This is due to the fact that most of the components are interlinked and work in synchronisation. Since this requires tweaking the system above the factory settings, it means increasing the power consumption, heat dissipation and many other factors. So before we get started, here are the mandatory things that need to be dealt with:

1. Exterminating dust:

Accumulation of dust decreases

a component's life span and performance, while decreasing the heat dissipation. Dust traps the heat and does not allow it to dissipate properly. It is very important to keep the dust away. So, open the cabinet and clean all components. Cleaning reduces noise, components run cool and hence their performance increases, significantly increasing headroom for overclocking. Make sure you are properly grounded, else the static

electricity from your body can damage the hardware components.

2. **Airflow:** Airflow plays a vital part in overclocking. A good airflow can decrease temperature drastically while bad/misaligned airflow can be fatal. Cabinets now come with at least two fans—one intake (front) and one exhaust (back). Usually, 120mm fans are preferred. Airflow is generally measured in CFM (cubic feet/metre). The more the CFM, the better the fan and its airflow. Few of the good brands are Scythe, Silverstone, Xigmatek, Antec, etc.
3. **Thermal compounds:** Also known as thermal pastes, thermal compounds are an important factor in cooling CPUs and GPUs. They transfer heat to the heat sink. A good thermal compound can reduce temperatures by 2-5 degrees Celsius. Some of the known brands are Arctic Cooling, Tuniq, etc.
4. **Cable management:** Messy cables inside the PC can hinder airflow, thus increasing the temperature. Cables hovering over the components can suffocate them resulting in their failure. So it's better to tie them, keeping them aside and away from the components' blowing/intake vents. You can use cheap cable ties to get the best results. If you want a permanent solution, cable covers and management kits are available off-the-shelf.



Warning: Although this guide encourages you to experiment with overclocking, I highly condemn the practice with laptops and desktops loaded with Pentium 4 (any generation) or Pentium D. These components usually run very hot and overclocking can result in system fiasco.

As I've mentioned earlier, overclocking is a vast topic, but in this article, we will only focus on CPU overclocking and not consider GPUs due to the dearth of mature

After-market heat sinks

Most hardware components suffer from the repercussions of overheating and other thermal catastrophes because of heat generation. Therefore we use heat sinks which helps in absorbing heat and keep the temperature from rising above safe levels.

To attain a higher CPU clock speed with well-controlled temperature, many companies offer after-market coolers. Most of the manufacturers allow high scalability by providing compatibility across all sockets of AMD and Intel. Therefore, even if you change the platform in future, you can continue to use the cooler, if compatible, or can increase the compatibility by spending on the mounting kit, if provided. Some of the top brands in the market are Thermalright, Prolimatech, Scythe, Artic Cooler, Coolermaster, etc.

If you intend to buy a cooler, then here is the list of some coolers that you can get for varying budgets:

- **Rs 1000-1,400:** OCZ Vanquishes 120mm (comes with fan installed)
- **Rs 1,500-2,000:** Thermalright Ultima 90 (doesn't include a fan) | Coolermaster Hyper TX2 Super (comes with fan)
- **Rs 2,000-2,500:** Sunbeam Core Contact Freezer 120mm | OCZ Vendatta 2 (both include a fan)
- **Rs 3,000 and above:** Thermalright Ultra Extreme 120mm | Prolimatech Megahalems (both don't come with a fan)

overclocking software for them.

CPU overclocking varies from processor to processor. Intel and AMD follow different approaches towards overclocking. To make things a little more complicated, CPU manufacturers opt for new terminology, which is often nothing more than a gimmick. Things are not as different as they seem.

There are generally multiple ways to overclock—manufacturers provide many options to boost speed. Generally, there are two types of processors available in the market: one with the locked multiplier (refer to the sidebar titled “Jargon buster”) and the other is with an unlocked multiplier. Processors with unlocked multipliers fall into a special category and are often termed as ‘Special Editions’. Intel uses the term Extreme Edition and AMD's offerings are known as Black Editions.

Both these special edition processors are cherry-picked, and have the best die and unlocked multipliers in them. As usual, they come with a premium in price. Thankfully, AMD's Black Edition won't burn a hole in your

pocket and a dual core is available for under Rs 6000. On the other hand, you will have to spend around Rs 50,000 for Intel's Extreme Editions. Yes, that's half a lakh for only a processor.

Take a look at the box to become familiar with some of the jargon used in relation to CPUs.

So once you have gained some knowledge about the basic terminology used while overclocking, it's time to overclock the system.

Generally, the preferred way to overclock the system is by tweaking the BIOS settings. Refer to your motherboard manual for precise information—different motherboard manufacturers have different BIOS menu structures.

We will start by disabling some energy efficient technologies that chip giants have actuated in the chips themselves. Here is the list of options that need to be disabled:

- **AMD Cool n' Quiet:** This is a power-saving technology that lowers the CPU clock speed and voltage when the processor is idle. This keeps the CPU from

System buying guide

Here is a list of systems with fairly decent overclocking headroom:

Budget System, around Rs 15,000

▪ AMD Athlon II X2 250	Rs 4,000
▪ Biostar A785GW – (ATI HD4200 Integrated Graphics).....	Rs 3,200
▪ Transcend 2GB DDR2 800 MHz RAM	Rs 1,200
▪ Western Digital 320 GB SATA2 Hard Disk	Rs 2,200
▪ Samsung/LG DVD Writer	Rs 1,200
▪ Gigabyte Superb 460W SMPS.....	Rs 2,200
▪ Zebronics Bijli	Rs 1,200
▪ OCZ Vanquishes AMD Edition (Optional)	Rs 1,200
Total.....	Rs 16,400

Mid End System, around Rs 20,000-27,000

▪ AMD Phenom II X2 550 Black Edition	Rs 4,900
▪ Biostar T790GXBE	Rs 4,400
▪ 4GB Gskill PI Black DDR2 800 MHz RAM	Rs 3,400
▪ Western Digital 1TB Green Hard Disk.....	Rs 4,200
▪ Samsung/LG/Lite On DVD Writer.....	Rs 1,200
▪ Corsair CX400 Seasonics 380W SMPS	Rs 3,200
▪ Antec 300 Cabinet.....	Rs 3,400
▪ Thermalright Ultima 90.....	Rs 1,900
▪ Scythe Sflex 65cfm 120mm fan	Rs 500
Total:.....	Rs 27,100

Mid End System Alternatives

- AMD Athlon II X4 620 Quad Core.....Rs 5,500
- Coolermaster CM590 Cabinet.....Rs 3,800
- ATI HD4850 | NVIDIA GTS 250 (512MB) VGA adapter....Rs 7,000

Mid-High End AMD System

▪ AMD Phenom II X4 955 Black Edition	Rs 11,000
▪ MSI GDFX-70	Rs 9,500
▪ OCZ AMD Black Edition Memory 4GB DDR3 1333 MHz RAM.....	~Rs 6,000
▪ Western Digital 1TB Black Edition Hard drive.....	Rs 5,400
▪ NVIDIA GTX 260	~Rs 10,000-11,000
▪ Samsung/LG/Lite On DVD Writer.....	Rs 1,200
▪ Corsair TX650 HX620 (modular) SMPS	~Rs 6,500 ~Rs 8,000
▪ Lancool PCK62 Cabinet	Rs 7,000
▪ Thermalright Ultra Extreme Black.....	Rs 3,400
▪ Scythe Sflex 75Cfm 120mm.....	Rs 500
Total:.....	Rs 60,500

Continued on next page...

heating up uselessly and reduces the electricity consumption. In the course of overclocking, we will be disabling CnQ if you have an AMD processor.

- **AMD C1E:** AMD C1E is a power management feature that suspends the system once it is idle.
- **Intel SpeedStep:** Intel SpeedStep is similar to AMD CnQ. Likewise, it reduces the system's power consumption by lowering the processor speed, when not in use.

Once you have disabled all the energy efficient techniques, it's time to start our business. Overclocking generally depends on the motherboard's capacity and capabilities; the better the motherboard, the better the processor will overclock. Of course, you need a capable processor, nonetheless.

To begin with, head on to the overclocking section of your BIOS (refer to the BIOS manual to locate this) and increase the FSB/HTT/BCLK by 2-5. If you have a special edition processor, then increase the multiplier by 1 from the default and save it. Return to Linux, and run the stress-testing program (we will learn about this later). If you have no errors or system performance issues, it means you have attained a stable overclock. Slowly and steadily, increase the value until you get to the point where the system stops responding. Kindly note, we have not yet increased the voltage of the system.

Once you have reached the limit, it's time to increase the voltage. A word of caution: Do not escalate the voltage value or you might end up with a fried CPU! Start by increasing from 0.05V and then continue increasing the BUS speed/multiplier till you get the maximum stable speed. Note: do not increase the voltage if you're using the factory shipped heat sink to cool the processor. Those cooling solutions are barely enough to cool the factory-shipped system, and increasing voltage on the default cooler might result in a dead processor. See the box titled 'After-market heat sinks' to get an idea

of the range of coolers that you might consider.

For a 65nm/45nm processor, you should aim for at least a 300-400 MHz stable overclock on stock cooling, while people with good cooling should aim for 600 MHz or even 1GHz.

Once you have attained a stable clock, keep it running 24x7 and notice the temperature while stress-testing; make sure it doesn't cross the maximum temperature allotted by the CPU manufacturer.

Stress testing/Prime95

Prime95 is the only efficient stress-testing program available for Linux, although the Linux version doesn't have a GUI. This test stresses the components and thus reveals any frailty. A stress-testing program stresses the CPU by upping the load to 100 per cent of the CPU cores. The processor will thus be overworked and the temperature will rise. If the overclock attained is unstable, the system might restart or stop responding while stress testing. This is a great way to check the stability of the system after overclocking.

Factors that affect overclocking

Even if you are well versed with the overclocking techniques, there is no guarantee that you will get the same results. Overclocking depends and varies with situations and the types of hardware components you use. So, I'd recommend extensive research before buying any of these components.

Let's take a quick look at what we should focus on before buying our hardware. Note that the dealers, most of the time, are uninformed and often have vested interests when they promote a product. So, do your homework on hardware peripherals before you buy them.

Conclusion

The benchmarking scenario is slowly and steadily improving in Linux. However, the clear lack of software potpourri does hurt. None of the programs tested provide an unblemished experience. For starters,

Continued from previous page...

System buying guide

Mid-High End Intel System

Intel Core i5 750 (LGA 1156)	Rs 11,000
Gigabyte P55 UD3R	Rs 13,000
Corsair XMS3 4GB DDR3 1333 MHz RAM	~Rs 6,500
Western Digital 1TB Black Edition Hard drive	Rs 5,400
NVIDIA GTX 260	~Rs 10,000-11,000
Samsung/LG/Lite On DVD Writer	Rs 1,200
Corsair TX650 HX620 (modular) SMPS	~Rs 6,500 ~Rs 8,000
Lancool PCK62 Cabinet	Rs 7,000
Prolimatech MegahaleM + LGA1156 Mounting Bracket	~Rs 4,200
Scythe Sflex 75cfm 120mm	Rs 500
Total: (with HX620 SMPS)	Rs 65,300 Rs 66,800

Mid-High End Alternatives


- ATI Radeon HD4890..... ~Rs 10,000
- AMD – AMD Phenom II X4 965 Black Edition..... Rs 13,000
- Intel – Intel Core i7 860 Rs 14,000-15,000

High End System

Intel Core i7 920 (LGA1366)	Rs 15,000
Gigabyte EAX58 UD5p	Rs 18,000
Corsair XMS3 6GB DDR3 1333 Triple Channel RAM	Rs 9,000
Western Digital 1Tb Black Edition Hard Drive x2	Rs 11,000
ATI HD5850	Rs 17,000
Samsung/LG/Lite On DVD Writer	Rs 1,200
Corsair TX750W SMPS	Rs 9,000
Lian Li A71F Cabinet	Rs 16,000
Prolimatech MegahaleM.....	~Rs 3,500
Scythe Sflex 75cfm 120mm	Rs 500
Total:.....	Rs 100,200

Note: All prices mentioned are courtesy [deltapage.com](#), [theitwares.com](#) and [primeabgb.com](#). The prices are quoted in INR and would vary depending on dealer discounts and product availability.

there are no overclocking software for CPUs, while there are a bunch of overclocking utilities for GPUs. The NVIDIA Control Panel does allow you to increase the memory and core speeds, while the AMD Overdrive is stagnating with no GUI on top. The lack of proper voltage and temperature measuring utilities is getting to be a sore point. Even with LM_Sensors and many other sensors, temperature monitoring isn't as precise as it should be.

Nonetheless, the benchmarking scenario is improving and will continue to do so since there is a sudden shift towards Linux. Stay tuned. 

By: Shashwat Pant

The author is a FOSS enthusiast interested in QT programming and technology. He is fond of reviewing the latest OSS tools and distros.