

HOW TO SET UP A BITCOIN MINER



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There are three main categories of bitcoin mining hardware, each more expensive and more powerful than the last. This guide to setting up a bitcoin miner explains each of them, and talks about how to make them work.

HOT TO MINE BITCOIN

By this stage, you will understand how bitcoin works, and what mining means. But we need to get from theory to practice. How can you set up a bitcoin mining hardware and start generating some digital cash? The first thing you're going to need to do is decide on your hardware, and there are two main things to think about when choosing it:

HASH RATE

This is the number of calculations that your hardware can perform every second as it tries to crack the mathematical problem we described in our mining section. Hash rates are measured in megahashes, gigahashes, and terahashes per second (MH/sec, GH/sec, and TH/sec). The higher your hash rate (compared to the current average hash rate), the more likely you are to solve a transaction block. The bitcoin wiki's mining hardware comparison page is a good place to go for rough information on hash rates for different hardware.



ENERGY CONSUMPTION

All this computing power chews up electricity, and that costs money. It's worth looking at your hardware's energy consumption in watts, when making your choice. You want to make sure that you don't end up spending all of your money on electricity to mine coins that won't be worth what you paid.

Use these two factors to work out how many hashes you're getting for every watt of electricity that you use. To do this, divide the hash count by the number of watts.

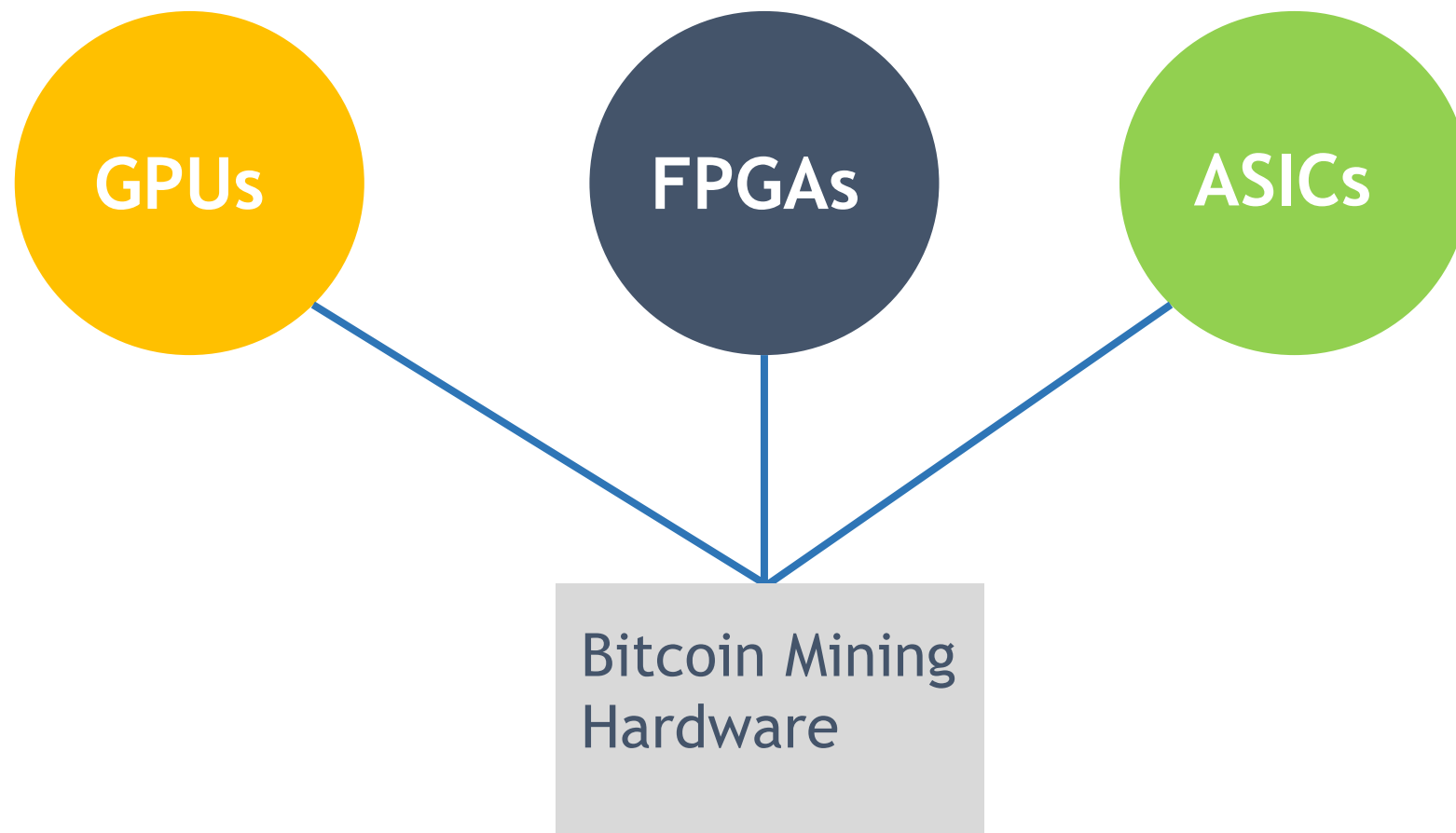
For example, if you have a 500 GH/sec device, and it's taking 400 watts of power, then you're getting 1.25 GH/sec per watt. You can check your power bill or use an electricity price calculator online to find out how much that means in hard cash.

However, there's a caveat here. In some cases, you'll be using your computer to run the mining hardware. Your computer has its own electricity draw on top of the mining hardware, and you'll need to factor that into your calculation.



BITCOIN MINING HARDWARE

There are three main hardware categories for bitcoin miners: GPUs, FPGAs, and ASICs. We'll explore them in depth below.



★ CPU/GPU BITCOIN MINING

The least powerful category of bitcoin mining hardware is your computer itself. Theoretically, you could use your computer's CPU to mine for bitcoins, but in practice, this is so slow by today's standards that there isn't any point.

You can enhance your bitcoin hash rate by adding graphics hardware to your desktop computer. Graphics cards feature graphical processing units (GPUs). These are designed for heavy mathematical lifting so they can calculate all the complex polygons needed in high-end video games. This makes them particularly good at the SHA hashing mathematics necessary to solve transaction blocks.

You can buy GPUs from two main vendors: ATI and Nvidia. High-end cards can cost hundreds of dollars, but also give you a significant advantage over CPU hashing. For example, an ATI 5970 graphics card can give you over 800 MH/sec compared with a CPU, which will generally give you less than 10 MH/sec.

One of the nice things about GPUs is that they also leave your options open. Unlike other options discussed later, these units can be used with cryptocurrencies other than bitcoin. Litecoin, for example, uses a different proof of work algorithm to bitcoin, called Scrypt. This has been optimized to be friendly to CPUs and GPUs, making them a good option for GPU miners who want to switch between different currencies.

GPU mining is largely dead these days. Bitcoin mining difficulty has accelerated so much with the release of ASIC mining power that graphics cards can't compete. If you do want to use them, you'd best equip yourself with a motherboard that can take multiple boards, to save on running separate PSUs for different boards.

BITCOIN MINING HARDWARE

★ FPGA BITCOIN MINING

A Field Programmable Gate Array is an integrated circuit designed to be configured after being built. This enables a mining hardware manufacturer to buy the chips in volume, and then customize them for bitcoin mining before putting them into their own equipment. Because they are customized for mining, they offer performance improvements over CPUs and GPUs. Single-chip FPGAs have been seen operating at around 750 Megahashes/sec, although that's at the high end. It is of course possible to put more than one chip in a box.

★ ASIC BITCOIN MINERS

This is where the action's really at. Application Specific Integrated Circuits (ASICs) are specifically designed to do just one thing: mine bitcoins at mind-crushing speeds, with relatively low power consumption. Because these chips have to be designed specifically for that task and then fabricated, they are expensive and time-consuming to produce - but the speeds are stunning. At the time of writing, units are selling with speeds anywhere from 5-500 Gigahashes/sec (although actually getting some of them to them to ship has been a problem). Vendors are already promising ASIC devices with far more power, stretching up into the 2 Terahashes/sec range.



CALCULATE MINING PROFITABILITY

Calculating Before making your purchase, calculate the projected profitability of your miner, using the excellent mining profitability calculator from The Genesis Block or this one. You can input parameters such as equipment cost, hash rate, power consumption, and the current bitcoin price to see how long it will take to pay back your investment.

One of the other key parameters here is network difficulty. This metric determines how hard it is to solve transaction blocks, and it varies according to the network hash rate. Difficulty is likely to increase substantially as ASIC devices come on the market, so it might be worth increasing this metric in the calculator to see what your return on investment will be like as more people join the game.

THINGS YOU NEED AFTER CHOOSING YOUR HARDWARE

DOWNLOAD THE SOFTWARE

Depending on which equipment you choose, you will need to run software to make use of it. Typically when using GPUs and FPGAs, you will need a host computer running two things: the standard bitcoin client, and the mining software.

STANDARD BITCOIN CLIENT

This software connects your computer to the network and enables it to interact with the bitcoin clients, forwarding transactions and keeping track of the block chain. It will take some time for it to download the entire bitcoin block chain so that it can begin. The bitcoin client effectively relays information between your miner and the bitcoin network.

BITCOIN MINING SOFTWARE

The bitcoin mining software is what instructs the hardware to do the hard work, passing through transaction blocks for it to solve. There are a variety of these available, depending on your operating system. They are available for Windows, Mac OS X, and others.

You may well need mining software for your ASIC miner, too, although some newer models promise to ship with everything pre-configured, including a bitcoin address, so that all you need to do is plug it in the wall.

One smart developer even produced a mining operating system designed to run on the Raspberry Pi, a low-cost credit card-sized Linux computer designed to consume very small amounts of power. This could be used to power a USB-connected ASIC miner.

JOIN A POOL

Now, you're all set up. Good for you. I bet you thought you were going to be mining more bitcoins than the Federal Reserve prints dollars, didn't you? Sadly not. You will stand little chance of success mining bitcoins unless you work with other people. You can find out more about that in our upcoming guide on how

