

Measurement, Comparison And Improvement Of The Performance Of The Graphics Cards Used In Ethereum Mining

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Abstract: Crypto money mining is a method that can be used with various types of processors based on block chain technology and can generate significant amounts of income in the present and future. Bitcoin, Ethereum, Monero and many other crypto coins are being excavated by process power owners all over the world and this leads to the transition to decentralized money system. In this study, the mining performances of 11 different AMD and NVIDIA chipset graphics cards that can be used for Ethereum mining are measured, compared and improved by using various techniques. Improvement in AMD chipset graphics cards has been influential on both power consumption and mining speed. At the NVIDIA side, the same mining speed can be achieved with lower power consumption.

Index Terms: Bitcoin, Blockchain, Coin, Cryptomoney, Ethereum, GPU, Mining.

1 INTRODUCTION

BITCOIN has been included in the scientific literature since 2008 with the article in Bitcoin: A Peer-to-Peer Electronic Cash System Bit. Bitcoin and subsequent Ethereum is a system that allows for anonymous and inexpensive transfer of assets between the opposite ends without the need for a central server or control point [1]. Crypto coins are values that can be obtained as a result of a challenging algorithm called mining. Any miner in the system uses the power of the graphics card or processor in order to obtain this solution. In order to solve the related algorithm as soon as possible and generate the block and confirm the accuracy of the transactions, the miner is given prize crypto money by the system [2]. The speed and energy consumption used to solve the algorithm are the most important factors determining the gain. When each new crypto currency is generated, the difficulty level of the system increases [3]. Miners benefit from the CPU (CPU) or graphics card (GPU) power of their computers while decoding these algorithms. It is known that CPUs' processing powers are not enough to solve the algorithm at Ethereum difficulty level. In this study, various graphics cards used for Ethereum mining, which is the largest part of the alternative crypto money ecosystem, have been tested. The model and memory quantities of the graphics cards used are as follows: Sapphire Nitro 4GB AMD R9 290, Asus Strix Dual 4GB AMD R9 380, Sapphire Nitro 8GB AMD R9 390, Gigabyte 4GB AMD RX 560, Sapphire Nitro 4GB AMD RX 470, Asus Turbo 8 GB NVIDIA GTX1080 Asus Turbo 8 GB AMD RX 570, Asus Dual 8 GB 8GB RX 580, Asus Dual OC 8 GB NVIDIA GTX1060, Asus Turbo 8 GB. The study is structured as follows: In the second section, information was given about Ethereum mining, the programs and equipment used. In the third section, the necessary improvements to increase the mining speed are presented in 4 parts. In the fourth section, the summary

production rate, power consumption and total income of the cards in the ex-works and improved condition are calculated and presented as a table. In the fifth section, the results and the studies that can be done are given.

2 ETHEREUM MINING

Ethereum mining is made possible by the systems that can solve the algorithm called Ethash [4]. As of January 2019, AMD and NVIDIA chipset graphics cards are very successful in solving this algorithm. For the centralized feature required for the crypto money system to function, a large number of miners working on GPUs with the Ethereum algorithm is vital to the operation and safety of the system [5]. A large number of miners from all over the world continue to solve Ethereum, guaranteeing that the network can transfer assets much more reliably, quickly and smoothly [6]. There are many open or closed source programs in Ethereum mining. In this study, Claymore Dual Miner program was used because it supports both AMD and NVIDIA chipsets. However, the program runs on Windows 10 operating system for easy operation and compatibility. Other versions of Windows, especially multi-GPU systems, are insufficient in mining. Windows 10 is capable of combining 12 graphics cards in one system and defining them; Windows 8.1 and Windows 7 can run 4 graphics cards without any problem. For this reason, the operating system preference is used in the direction of Windows 10. MSI Afterburner 4.6 software is used to change and monitor the display features such as power limit, processor speed, memory speed, fan speed, and processor voltage.

The systems used in Ethereum mining are composed of basic computer parts. A processor, a motherboard with the required PCI-Ex slot, at least 4 GB of RAM, at least 700 watts of power, and if possible gold-certified 80+ efficient power supply, at least 90 GB SSD, the riser card to bring the PCI-Ex slots to the appropriate position and To control the system, the monitor, keyboard and mouse are the necessary hardware. The processor can be selected from Intel or AMD companies at current low-speed processors. In crypto-money mining made with graphics cards, the processing power does not affect the mining speed. In this study, Intel G4400 processor with 3.3 GHz operating frequency is used. Minimal 4 GB of RAM is required for the Windows 10 operating system to work easily with the miner software. For both speed and temperature, SSD should be used as a hard disk in the system. Power supply is

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the most critical part of mining systems. Since the display cards will operate continuously, a power supply with a capacity to power at least 1.5 times the power consumption should be preferred. In this way, the power supply will be more efficient, which is an important parameter in terms of cost reduction. The EVGA 750 Watt Gold certified 80+ efficient power supply provides the required features. The difference between the power drawn from the socket and the used power is low in terms of the profitability of the system in our country where the electricity is approximately 0.1 USD / kwh. A watt meter was used to make the measurements.

3 OPTIMIZATION OF MINING HASH RATE

The models of 8 different AMD and 3 different NVIDIA cards used in this study and some critical factory output parameter values are given in Table 1. With the 4-step change package made on these parameters, the mining process is made more profitable and the heat dissipated to the environment is reduced and the working conditions and life span have been increased. It is possible to make the timings of the memory cards of the graphics cards faster by reprogramming the graphics card BIOS. However, changing the BIOS on the 10xx series NVIDIA chipset cards is prohibited by the manufacturer. For this reason, only AMD chipset graphics cards can be improved by tightening memory timings. The BIOS ROM file obtained with the appropriate programs is processed with the Polaris Bios Editor and ATIWINFASH programs to make the memory run faster. This process is not simply about increasing the memory speed. RAM, CAS, RAS, tCL, tRCD, tRP, tRAS, such as waiting times are changed and thus the graphics card has the power to solve more algorithms.

	R9 290	R9 380	R9 390	RX 560	RX 470	RX 480	RX 570	RX 580	GTX 1060	GTX 1070	GTX 1080
GPU Core (MHz)	1000	990	1010	1300	1242	1300	1268	1411	1784	1771	1822
GPU RAM (MHz)	5200	5500	6000	7000	6600	7000	7000	7000	8008	8008	10008
GPU Supply (mV)	1300	1200	1300	1000	1150	1200	1200	1200	900	1000	1000
TDP (Watt)	275	190	275	75	120	150	120	185	120	150	180

Fig 1. Factory Settings of GPUs

Ethereum mining is more affected by the memory speed of the graphics card. However, increasing the core speed will contribute to the solution of the algorithm. With MSI Afterburner 4.6 you can easily overclock over Windows. The rate of the increase will be different for each chip and every model card. Speed overruns were applied in 20 MHz steps and each time the system was tested to be stable. Especially in NVIDIA graphics cards, the drawn current values are kept too high in order to prevent the card from becoming unstable and to be one step ahead of its competitors in power applications. With the MSI Afterburner program, the 70 percent power limit on NVIDIA chipset cards and the 80 percent power limit on AMD chipset cards do not reduce the algorithm decoding speed, but reduce power consumption. Table 2 shows the power limit values applied to the cards. At the point where the Ethereum digestion rate began to be affected, it was assumed that the appropriate value for the power limiting

process was found. The supply voltages of the processors in graphics cards are very decisive for the power consumption of the card. Considering the value of the mining speed, decreasing the supply voltage in 10mV steps in a way that will not affect the working stability of the card will give a positive result in terms of decreasing the power consumption. Reducing the power consumption will also result in a reduction of the heat emitted by the card, which will increase the life of the card and increase the profit of the mining process. In the present study, the CPU supply voltages of the graphics cards have been reduced in different amounts for each card, and the appropriate values have been determined by taking into consideration the power consumption and the algorithm speed. These values are shown in Table 2.

4 MEASUREMENT RESULTS

The techniques of changing the memory timings, increasing the graphics card GPU and RAM speeds, reducing the power limit and reducing the processor supply voltage were applied to each card, and the excavation speed and power consumption measurements were made. The measurement device used is given in Figure 1.

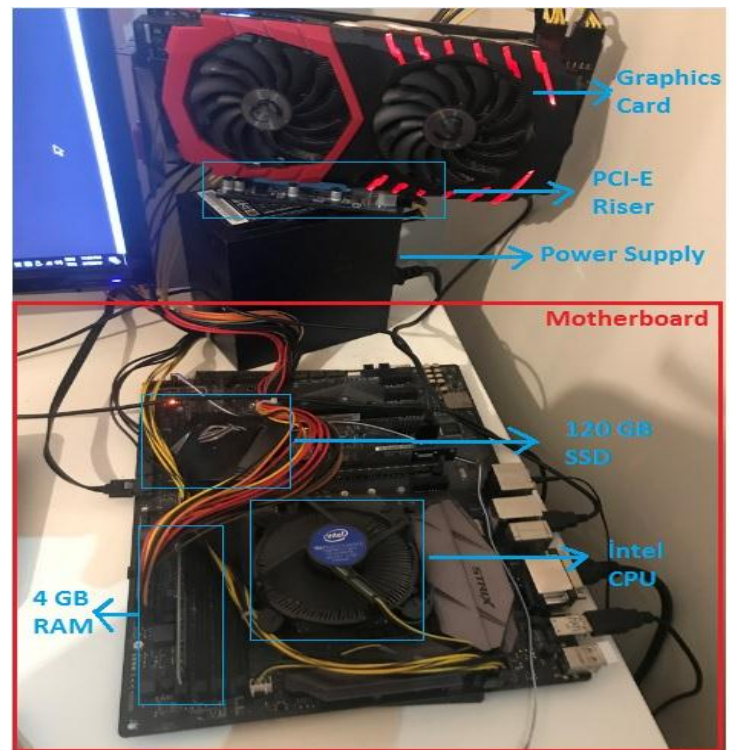


Fig 2. Measurement system

		Bios Mod.	Hash Rate (MH/s)	GPU Over Clock (MHz)	RAM Over Clock (MHz)	GPU Under Volt (mV)	Power Limit	Diss. Power. (Watt)	Revenue (USD/Day)	Electricity Cost (USD/Day)	Profit (USD/Day)
AMD	Stock	X	22.4	0	0	0	%100	275	0.23	0.64	-0.41
R9 290	Mod.	X	27	+100	+200	-70	%80	180	0.27	0.42	-0.14
AMD	Stock	X	19.5	0	0	0	%100	150	0.20	0.35	-0.15
R9 380	Mod.	X	21	+100	+150	-80	%80	130	0.21	0.30	-0.09
AMD	Stock	X	24	0	0	0	%100	275	0.24	0.64	-0.40
R9 390	Mod.	✓	28	+100	+150	-50	%80	170	0.28	0.40	-0.12
AMD	Stock	X	10	0	0	0	%100	75	0.10	0.17	-0.07
RX 560	Mod.	✓	14	+100	+350	-90	%80	60	0.14	0.14	0
AMD	Stock	X	23	0	0	0	%100	120	0.23	0.28	-0.05
RX 470	Mod.	✓	29	+100	+350	-150	%80	100	0.29	0.23	0.06
AMD	Stock	X	24	0	0	0	%100	150	0.24	0.35	-0.11
RX 480	Mod.	✓	30	+100	+300	-150	%80	110	0.31	0.26	0.05
AMD	Stock	X	23	0	0	0	%100	120	0.23	0.28	-0.05
RX 570	Mod.	✓	29	+100	+300	-150	%80	90	0.29	0.21	0.08
AMD	Stock	X	24	0	0	0	%100	185	0.24	0.43	-0.19
RX 580	Mod.	✓	29	+100	+300	-150	%70	130	0.29	0.30	-0.01
NVIDIA	Stock	X	20	0	0	0	%100	120	0.20	0.28	-0.08
GTX1060	Mod.	X	22	+100	+600	0	%65	70	0.22	0.16	0.06
NVIDIA	Stock	X	24	0	0	0	%100	160	0.24	0.37	-0.13
GTX1070	Mod.	X	30	+100	+600	0	%65	90	0.30	0.21	0.09
NVIDIA	Stock	X	28	0	0	0	%100	200	0.28	0.47	-0.18
GTX1080	Mod.	X	34	+100	+300	0	%65	110	0.35	0.26	0.09

Fig 3. Measurement Results

In order to make a comparison, the measurements of the graphics cards in the factory settings are also made. For example; The stock rate of the AMD RX 570 graphics card was measured at 23 MH/s. In this case, the power consumption was measured at 120 Watts and the card was able to mine 0.002326 Ethereum per day [7]. The daily income was 0.23 USD and the energy cost was 0.28 USD. In case of ex-factory, the mining damage of the card was 0.05 USD per day. When the same card was improved with the techniques proposed in this study, the digestion speed was measured as 29 MH/s and the power consumption was 90 Watt. In the improved state, the AMD RX 570 can digest 0.003011 ETH per day. The daily income was 0.29 USD and the energy cost was 0.21 USD. In this case mining profit was calculated as 0.08 USD per day [7]. Table 2 shows the measurement results of the stock and modulated cards of all the graphics cards and the daily amounts of profit obtained.

5 CONCLUSION

The most important aim of this study is to apply optimization methods in Ethash summary algorithm which is specific for Ethereum mining. For this purpose, improvements have been made to enable AMD and NVIDIA chipset graphics cards to solve faster algorithms with lower power consumption. In the study, Ethereum, which has an instant price of 118 USD and kwh unit price of electricity is 0.1 USD. When the graphics cards were operated with the factory default settings, none of them could profit from the current exchange rates. RX 470, RX 570, GTX 1060, GTX 1070 and GTX1080 cards were found to be in the snow zone when improved with the techniques proposed in this study. Reducing the power consumption along with increasing the speed of the algorithm has been an important factor in transition to the snow zone. When compared to AMD graphics cards, NVIDIA graphics cards are currently in the process of producing more solutions in Ethereum mining for less power. In the future study, it is

thought to add crypto coins such as Ravencoin, Bitcoin Gold and Monero with different algorithms from Ethereum. In addition, it is planned to continue with the efforts to increase profit in the field of algorithms from Ethereum. In addition, it is planned to continue with the efforts to increase profit in the field of cryptocurrency, by writing a software that allows the instantaneous exchange of crypto money.

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