



## The GPU Shortage: Another Victim of the Supply Chain Crisis

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### *Overview*

A GPU (Graphics Processing Unit) is a physical unit of a computer that processes data into 2D and 3D graphics by performing complex calculations to map out images (Berman, 2022). GPUs are essential to most computers and have increased in demand due to multiple new applications.

There are two main types of GPUs. A dedicated graphics card (GPU) is generally used in higher-end desktops and is physically separate from the motherboard (Berman, 2022). An integrated GPU is mounted to the motherboard and is not removable (Berman, 2022). Integrated GPUs are generally in lower-end desktops and most laptops as they are practical for everyday use such as watching videos and reading text. However, most modern 3D games require dedicated graphics cards to adequately display the detail

and quality of images. There is currently an international GPU shortage. On most GPU websites one will likely find that GPUs are out of stock or listed at a significant markup. It has become nearly impossible to buy a modern GPU without paying over 200% of the MSRP. Most stores no longer take waitlists due to large backorders. Currently, we are undergoing the biggest GPU shortage to date. No end seems to be in sight.

### *What is impacting GPU supply?*

Cryptocurrency mining has significantly impacted GPU supply. As cryptocurrency continues to grow in popularity, the volume of cryptocurrency miners will continue to grow as well (Bispo, 2021). GPUs are used to solve complex mathematical problems to mine for cryptocurrencies (Bispo, 2021). Large-scale crypto mining operations are known to buy large quantities of GPUs

from websites using bots. Bots are bits of software that can complete tasks such as making purchases on websites and gathering data (Computerinfobits, 2022). They act quickly to process purchase orders before actual consumers are notified of stock replenishments. High-end GPUs are sought after by crypto miners for their speed as miners are in a constant rat race against each other (Bispo, 2021).

Individuals known as GPU Scalpers are also contributing to this shortage. GPU Scalpers are individuals who purchase large sums of GPUs from websites using bots and resell these GPUs at a large markup on third-party marketplaces, undoubtedly contributing to the high demand and significant markup (Computerinfobits, 2022).

The “Bullwhip Effect” is another phenomenon that can explain the GPU shortage. The bullwhip effect is when a sudden spike in demand occurs and in response, retailers order slightly more than the anticipated demand. As a result of the retailers’ response, suppliers then also order slightly more than the retailers (Ridley, 2021). This pattern continues down the supply chain and magnifies, with everyone eventually waiting for backorders (Ridley, 2021). Once all orders are filled, demand appears to decrease, leaving retailers left with extra inventory. Retailers fear this eventual decrease in demand and are not willing to place large orders they may not be able to sell. GPUs have short shelf lives and thus, retailers do not want to be left with last generation GPUs they cannot sell. (Ridley, 2021).

Another factor contributing to this shortage is the COVID-19 chip shortage. Computer chips are used in GPUs, and there are only a handful of chip manufacturers, the largest producers being TSMC, Intel, and Samsung (Ridley, 2021). These companies have promised expansion. For example, Intel recently broke ground on two new factories in Arizona (Ridley, 2021). However, chip

production is complex as chips require many different materials such as silicon, metals, and minerals for wafers and circuitry (Ridley, 2021). This makes the GPU supply chain particularly complex and working to increase quantity can take several years.

#### *Who has been affected?*

This shortage affected PC gamers significantly, as a dedicated GPU is required to play most modern games. In turn, they are left with two choices: overpaying for a GPU or being left without a method to game. Cloud gaming services like Google Stadia have attempted to mitigate these issues by offering another method to play without owning a GPU. However, cloud gaming is no match for the speed and quality that a personal GPU provides.

Console manufacturers are also affected by this shortage. PlayStation 5 (PS5) and the Xbox series X/S consoles are scarcely supplied. Sony itself has stated that it is having trouble manufacturing PS5s due to logistics and the chip shortage (Martin, 2022). This has left many console gamers stuck without a console or with their previous generation consoles. Consequently, console companies are losing revenue as they are unable to meet demand.

#### *Solutions that have been tried*

Nvidia has attempted to deter crypto miners from purchasing GPUs by limiting their hash rate (Kan, 2021). A hash rate can be thought of as a measure of how fast a GPU computes (Kavanagh, 2022). This limit was only effective for the cryptocurrency “Ethereum” (Kan, 2021). Miners seemed to have found a loophole as some miners were able to restore up to 70% of the mining performance to Ethereum and allocate 30% to a second cryptocurrency (White, 2021). This resulted in no significant difference made to supply. Another loophole sought by miners was

the ability to buy supplies of GPUs which did not have the hash rate limitation, such as the RTX 3090, a top-of-the-line dedicated GPU offered by Nvidia (Kan, 2021).

Stores have employed anti-bot measures on their websites, however, these have largely been ineffective (Whitwam, 2022). Although Best Buy had implemented an expensive paywall, this in turn had actually assisted scalpers. One had almost bought \$20,000 in GPUs (Kan, 2022). Skilled bot programmers also possess the ability to reverse engineer website security and bypass it. One way to combat bots could be to have releases in-person, until stock stabilizes. This method could ensure that each person has a verifiable identity and only purchases a set quantity.

### *Implications*

Some implications of the GPU shortage could be a decrease in the number of game releases, crypto mining, and jobs for professionals. Without a steady supply of modern GPUs, game development companies have not been able to create games as rapidly. Crypto mining may also decrease as fewer cryptocurrencies can be mined. This implication could possibly further lead to a slight increase in cryptocurrency values as the stream of new coins may decrease. Furthermore, the shortage of crypto mining may also lead to a decrease in jobs for professionals such as 3D modellers and animators. All in all, the implications of the GPU shortage could be overarching.

# REFERENCES

- Berman, M. (2022, March 2). What is a graphics card? *Programming Insider*. <https://programminginsider.com/what-is-a-graphics-card/>
- Bispo, N. (2021, December 27). Cryptocurrency, graphics card shortage, and the rise of cloud GPU. *Medium*. <https://medium.com/geekculture/cryptocurrency-graphics-card-shortage-and-the-rise-of-cloud-gpu-1d5501351ed3>
- Computerinfobits. (2022, February 14). What is GPU scalping and why is it so bad? *Computerinfobits*. <https://computerinfobits.com/what-is-gpu-scalping/>
- Hong, E. (2022, March 14). How does bitcoin mining work? *Investopedia*. <https://www.investopedia.com/tech/how-does-bitcoin-mining-work/>
- Kan, M. (2021, May 18). Nvidia expands mining limiter to RTX 3060 ti, 3070, 3080 graphics cards. *PCMag*. <https://www.pcmag.com/news/nvidia-expands-mining-limiter-to-rtx-3060-ti-3070-3080-graphics-cards#:~:text=The%20great%20GPU%20shortage%20has,%2C%E2%80%9D%20Nvidia%20said%20on%20Tuesday>
- Kan, M. (2022, February 11). \$199 Totaltech paywall helps scalper snag 20+ gpus from Best Buy. *PCMag*. <https://www.pcmag.com/news/199-totaltech-paywall-helps-scalper-snap-20-plus-gpus-from-best-buy>
- Kavanagh, R. (2022, February 8). Hash rate: A measure of the computing power on a cryptocurrency network that is a key security indicator. *Business Insider*. <https://www.businessinsider.com/personal-finance/hash-rate#:~:text=Hash%20rate%20is%20the%20total,of%20miners%20are%20verifying%20transactions>
- Martin, A. (2022, February 2). PS5 shortages set to continue due to global chip shortage, warns Sony. *Sky News*. <https://news.sky.com/story/ps5-shortages-set-to-continue-due-to-global-chip-shortage-warns-sony-12530975#:~:text=News%20%7C%20Sky%20News-,PS5%20shortages%20set%20to%20continue%20due%20to%20global%20chip%20shortage,increase%20in%20Sony's%20operating%20profits>
- Ridley, J. (2021, November 24). Why you still can't buy a graphics card according to a supply chain expert. *pcgamer*. <https://www.pcgamer.com/why-you-still-cant-buy-a-graphics-cards-according-to-a-supply-chain-expert/>
- White, M. J. (2021, October 7). *Crypto miners bust through Nvidia's LHR core yet again*. Digital Trends. <https://www.digitaltrends.com/computing/crypto-miners-bypass-nvidia-rtx-lhr-again/>
- Whitwam R. (2022, February 22). GPU scalper bots are still dominating AMD's online store. *ExtremeTech*. <https://www.extremetech.com/gaming/331879-gpu-scalper-bots-are-still-dominating-amds-online-store>