ACCESS MINING

How a Prominent Cryptomining Botnet is Paving the Way for a Lucrative and Illicit Revenue Model

By Greg Foss and Marina Liang, Carbon Black Threat Analysis Unit
ACCESS MINING REPORT

ACCESS MINING OVERVIEW

Carbon Black’s (CB) Threat Analysis Unit (TAU) has uncovered a secondary component in a well-known cryptomining campaign. The malware has been enhanced to also steal system access information for possible sale on the dark web. Combined together, this attack is being classified as “Access Mining.” This discovery indicates a bigger trend of commodity malware evolving to mask a darker purpose and will force a change in the way cybersecurity professionals classify, investigate and protect themselves from threats.

Access Mining

Access Mining is a tactic where an attacker leverages the footprint and distribution of commodity malware, in this case a cryptominer, using it to mask a hidden agenda of selling system access to targeted machines on the dark web. Access Mining involves adding a remote access Trojan (RAT) to commodity malware, collecting access descriptors, then listing that information on access marketplaces.

Evidence of Access Mining

Carbon Black discovered Access Mining while investigating a prominent cryptomining botnet, Smominru. In addition to mining Monero cryptocurrency, it has evolved to also backdoor infected systems and expand their capacity to mine while exfiltrating sensitive system information. Based on the specific system details they gathered, it is plausible this information could be sold on an access marketplace, allowing for remote access into these systems for use as zombies in large-scale attacks or to execute targeted attacks on specific hosts at specific companies.

Why You Need to Be Aware of Access Mining

This discovery and investigation demonstrates how virtually any company could be leveraged in a targeted attack—even if that company lacks a worldwide brand, known intellectual property assets, or a Fortune 1000 listing. Access Mining represents a scalable and economical approach for an adversary to find valuable targets. Combined with the rapid growth in island hopping (50% of attacks utilize this technique) as reported in Carbon Black’s April 2019 Global Incident Response Threat Report, this illustrates how a supply chain can potentially be hijacked to navigate from lower-tier targets to higher-tier targets.

Protect Yourself with Upgrades and EDR

With the expectation that Access Mining will become a much more common tool in the attacker’s toolkit, it is wise for security architects to increase the prioritization of removing commodity malware, upgrade systems to Windows 10, upgrade any IIS v7.5 web servers in your environment, and utilize endpoint detection and response (EDR) to monitor for malicious behavior and protect your systems from unauthorized access.
Key Findings from Access Mining Investigation

CB TAU had been investigating the behaviors of a known cryptomining campaign, Smominru, and discovered that the threat actor evolved their cryptomining capabilities with additional tools for collecting and exfiltrating sensitive information from victim computers to various file transfer protocol (FTP) servers running on compromised infrastructure.

Prompted by the discovery of new dredge-net style information collection and remote access components associated with the Smominru campaign, TAU asked the question, “Why would a cryptomining campaign need to extract sensitive information and leverage a RAT?”

This question led to the hypothesis that these systems were being profiled for the purpose of selling access to buyers interested in that type of machine, especially any machine that happens to be located within a particular company of interest. Furthermore, based on the evidence uncovered, this campaign has been actively underway for the past two years, infecting systems en-masse and actively spreading by way of EternalBlue.

Through the course of this investigation, we believe we have discovered in the wild all the elements that would be required to successfully execute an end-to-end Access Mining campaign. While we cannot conclude that the threat actor in question is definitively selling access to targeted hosts, we do believe that the findings below are consistent with this behavior and demonstrate that such a complex and dangerous campaign is plausible.

Finding 1: At least 500,000 machines affected
Victims have been predominantly located in Asia Pacific, Russia and Eastern Europe. Analysis of the infrastructure and supporting research by additional security firms indicates that the total number of infected systems is well over 500,000 machines.

Finding 2: Threat actor using repurposed tools, modified exploits and stolen infrastructure
In previous campaigns this threat actor used a modified version of XMRig to perform Monero mining. In addition to the modified XMRig, the group now uses readily available malware and open source tooling, such as Mimikatz and EternalBlue, which they have modified for their purposes to pivot from infected systems and expand their campaign’s reach. Their C2 infrastructure is mainly comprised of compromised IIS v7.5 servers that they use to host toolsets and collect stolen data (including external IP addresses, internal IP addresses, domain information, usernames and passwords). It is highly plausible that they have established a separate revenue stream based on selling remote access in darknet marketplaces.
Finding 3: Newly uncovered link between Smominru and MyKings

This investigation highlighted an unexpected link between Smominru cryptomining campaign and the MyKings botnet. While the campaigns used different domains, the same email address (billkillmenow[at]gmail[dot]com) was used at one point to register domains used in each campaign. At the time of writing this article, the registration has been shifted to another alias for the MyKings domains, but remains the same for a majority of the Smominru domains. This link helps to show the breadth of the threat actor and the ability to leverage multiple campaigns together to execute Access Mining.

Finding 4: Rapid evolution thanks to open source exploits

While the link between Smominru and MyKings helps to explain the connection between cryptomining and Access Mining, easy access to open source exploits also played a role in this evolution. Modified versions of Cacls, XMRig and EternalBlue were used in this campaign. Obtaining the bulk of the code via open source sites like GitHub likely sped up the innovation to Access Mining. While EternalBlue became well known thanks to WannaCry, many organizations have been slow to patch, leaving themselves vulnerable to this known exploit. These open source exploits originated from the National Security Agency (NSA), but were stolen by the Shadow Brokers in 2016 and put on the market for sale.

Finding 5: Combining commodity malware with access-for-sale is lucrative at scale

The business model for Access Mining combines a profit stream from cryptomining with a profit stream from selling system access. Both can be highly lucrative if done at scale. As of the writing of this report, the Monero value was hovering around $90. Assuming the threat actor has recovered enough infrastructure to regain its pace of mining 8,900 Monero over six months, then they stand to make $1.60M annually. Additionally, they now have the system access profit stream. If they are able to sell just half of the 500,000 systems they have infected over a year at an average price of $6.75, they will earn around $1.69M for a total annual revenue of $3.29M. As the value of the Monero and/or the volume or value of system access increases, so does profit.

In September of 2017, Carbon Black’s (CB) Threat Analysis Unit (TAU) analyzed more than 1,000 ransomware samples and found behavioral trends that led to seven predictions as to how ransomware would evolve. The predictions included the ideas that ransomware would be used as a smokescreen and that it would be modified to exfiltrate data. Fast forward to 2019 and both predictions have unfortunately become a reality with this new threat, Access Mining.
Factors Leading to Innovation of Access Mining

The evolution of the threat actor activity from a seemingly low-risk commodity malware to more nefarious tactics for Access Mining can be better understood by looking at the economic and market factors during this time period. Changes in cryptocurrency value, availability of cyber tools and interesting links in campaigns all contribute to how and why this threat actor evolved.

**ACCESS MARKETPLACES**

Dark web access marketplaces become a way to make money at scale

**SMOMINRU**

Likely Active

8,900 Monero mined (approx. $3M)

ISP Sinkhole removes 1/3 of infrastructure

**NSA LEAKS**

ShadowBrokers began NSA tool leak auction/sale

Former NSA tools like EternalBlue readily available on GitHub

**MYKINGS**

Likely Active

Link found between Smominru & MyKings in domain registrations

**MONERO VALUE**

- JAN 2016
- JUL 2016
- JAN 2017
- JUL 2017
- JAN 2018
- JUL 2018
- JAN 2019
- JUL 2019

Detailed on following page
Monero Devaluation and ISP Sinkhole Drops Profitability

Looking at the Smominru campaign, it is noteworthy that the threat actor ran into two major setbacks that reduced their revenue drastically. The first was the devaluation of the Monero currency throughout 2018. Monero peaked January 7, 2018 at a value of $494.16 and plummeted as low as $39.41 on December 18, 2018. Monitoring of Smominru by Proofpoint, during the last six months of 2017, showed they had mined 8,900 Monero worth approximately $3M. With the drop in Monero value, the Smominru campaign likely made well under $1M by the latter half of 2018.

The second major setback encountered was an ISP sinkhole, where the DNS provider gave false results to prevent use of a domain, that removed their access to a third of their C2 infrastructure in January 2018. While they recovered some of this infrastructure, this likely cut the amount of Monero they could mine by at least 25%, dropping their revenue closer to $600K over a six-month period. A $2.4M drop in profitability over six months likely motivated the pivot to Access Mining.

Actors Like Shadow Brokers Contribute Technology

Back in 2016, the Shadow Brokers began selling stolen NSA cyber tools on the dark web. This effort ultimately resulted in many powerful exploits being available as open source projects on GitHub. This includes EternalBlue, which plays a major role in spreading the malware package used by this threat actor. Additionally, Mimikatz by Benjamin Delpy and related post-exploitation open source tools are readily available and critical in the execution of this campaign.

Surprising Link Between Smominru and MyKings

Easy access to EternalBlue assisted the threat actor in their ability to proliferate their campaign. Carbon Black uncovered that while Smominru and MyKings used different domains, their domain registration tied back to the same email address, which has since been updated to a new alias. This is the first time these two prominent botnet campaigns have been linked to the same threat actor.

Access Marketplaces Provide Remote Access at Scale

The last factor to consider is the established e-commerce platform for selling system access on access marketplaces (see page X). With inexpensive prices comes an active market where profit comes from providing a high volume of system access. Combining all of these factors paints the picture of a threat actor who had motivation to move away from commodity malware, but instead had the right tools and environment to evolve the commodity threat to mask a new cybercrime business model of mining system access for resale and distribution. Now, instead of relying solely on revenue from Monero mining, they have supplemented that revenue with the sale of remote system access at scale.
Key Elements of Access Mining Campaigns

The existence of Access Mining forces the cybersecurity field to take a closer look at commodity malware and search for the hidden agenda of establishing persistent remote access and exfiltrating sensitive system information. There are seven basic components of an Access Mining campaign that cybersecurity professionals should be looking for.

1. **Extension of commodity malware** – The attacker starts with a commodity malware package that has been built or extended to gather information about the victim that will later be used to market access to that host in order to get the highest premium. In the example described in this report, the mominru cryptomining malware was enhanced with reconnaissance, RAT and spreading capabilities for these purposes.

2. **Distribution method** – To get commodity malware distributed as broadly and cheaply as possible, the malware will have a spreader. In this case, EternalBlue was leveraged to automate the pivoting from one system to the next within a domain environment. Look for abnormal and/or high volume of traffic from NetBIOS and SMB ports.

3. **Establish persistence** – To ensure continued unfettered access to the host, often multiple persistence methods will be observed. This is key when it comes to ensuring long-term access to the target host and ensures the effectiveness of the overall campaign. Common methods observed are the utilization of Windows Management Instrumentation (WMI) Event Subscription, Scheduled Tasks and Registry Modification.

4. **Collection of host data** – A key trait of Access Mining is the collection of various host information along with credentials and domain identification. In this case, PowerShell collected data such as external IP and OS fingerprinting. Then invoking PowerSploit’s PowerShell Mimikatz script, the credentials are scraped from lsass.exe and written out to a raw text file.

5. **Exfiltration of sensitive data** – Once the data is collected, the data is exfiltrated out of the network, often in plain text. In this scenario, compromised IIS v7.5 servers were utilized to collect and transmit the data over FTP.

6. **Resale method for host access** – In order for the threat actor behind an Access Mining campaign to make money, one option is to provide the stolen credentials or direct system access through a marketplace to be sold for cryptocurrency. There are various types of access marketplaces reachable on the dark web, requiring various degrees of authorization before allowing someone to transact. These marketplaces vary in terms of the type of access, permission level, system performance, network performance and other variables depending on the marketplace. Some marketplaces specialize in providing access by company as well.

7. **Targeted access through the embedded RAT** – Once a transaction is completed in an access marketplace, system credentials and/or remote access (via RAT, RDP, etc.) are provided on a members-only dark web marketplace. Depending on the system, domain, performance, etc., the systems are ranked and sold at various price ranges, based on perceived value. This opens up a path for potentially purchasing access into a target organization, leveraging the system for large-scale attacks such as DDoS, or island hopping into another organization by proxy.
What Is an Access Marketplace?

Access marketplaces provide a quick and easy way for cybercriminals to purchase access to systems and organizations, whether through providing credentials or remote access tools, on the dark web. These systems can be used as zombies in large-scale attacks or as an entry point to a targeted network. Founded in 2016, one of the most popular known access marketplaces is Ultimate Anonymity Services (UAS). UAS offers over 35,000 credentials for sale in a variety of countries and for a variety of Windows operating systems. Prices on UAS range from $4 to $20 with an average selling price of $6.75—although other marketplaces have systems as high as $100. On UAS, pricing is dependent upon geo-location, the listing’s age and whether the system is blacklisted by an e-commerce fraud checking system. On other marketplaces with higher price points, the data on the system and which enterprise applications are installed figure heavily into the price.

Pricing for remote access can be highly lucrative for the right host. For example, in a prior investigation we discovered a system for sale at $7,000—this system appeared to be an accountant’s system with tax filing software installed. Well beyond that was the much-publicized report of hackers obtaining access to the networks of three antivirus companies in the U.S., including source code for their systems. The hacking group was offering access information to each of these networks for the not insignificant sum of $250,000, but that number could go as high as $1 million.

Sample listing of system access available for sale on an access marketplace

Marketplaces Provide Inexpensive Remote Access

With the low cost of remote system access, this has become a standard intermediary for cybercriminals looking to execute campaigns using dissociated systems. An example of a frequent shopper is a threat actor that runs carding schemes. They use remote systems to execute the “cash-out” portion of the scheme, making larger purchases to be delivered to mail drops for further black market resale.

Profit Sharing Re-Sales

Another interesting feature of access marketplaces is an “automatic re-sale” where after 24 or 48 hours the server is made available for purchase again. These re-sales operate on a profit-sharing model between the original purchaser and the marketplace.

Sellers Can Make Millions

Selling system access is a volume game, although a single computer at a high-profile company can be incredibly valuable on its own. Each week around 2,500 systems are added to the UAS marketplace. The average value of systems added each week is around $16.5K. Researchers cannot identify the exact amount of systems sold to calculate the revenue of a threat actor selling system access. However, if an actor had access to 500,000 systems—as identified in this report—and sold even half of them via access marketplaces, they could earn $1.69M.
Mitigate Your Risk of Access Mining

With the expectation that Access Mining will become a much more common tool in the attacker’s toolkit, it is wise for security architects to take the following steps across security policy, active monitoring and IT hygiene to address potential exposure.

**Policy**
- **Don’t underprioritize low-level threats:** Commodity malware, like the Smominru cryptominer, are evolving and can open the door for higher-level threats. Many companies would naturally prioritize a nation-state alert over a cryptomining alert, but this example shows why that may be a dangerous practice.
- **Equip yourself with up-to-date behavioral intelligence of every application:** Follow the well-known best practice dictated by CIS (Center for Internet Security) Critical Security Control #2: Inventory and Control of Software Assets. But be cautious about relying on a classification for applications with low or no reputation. As this example shows, multi-purpose malware means a cryptominer can become much more.
- **Use the MITRE ATT&CK Framework to inspect for gaps:** This framework can help you understand where your defenses are strong and where you need to shore up. Align this framework with the appropriate behavioral intelligence so you can focus on what’s most impactful.

**Monitoring**
- **Monitor for malicious behavior using endpoint detection and response software:** Install an analytics-based EDR solution on your endpoints to identify malicious behaviors of known, unknown and evolving threats.
- **Deploy technologies that provide an orchestrated collective defense:** Automation through APIs and integrations are key to handling the volume of security data and complex security behaviors rapidly and responsively.
- **Handle alert overflow using an outsourced MDR / MSSP:** It may be time to tap into third-party experts to triage, investigate and process security alerts—especially with the security skills gap most companies face.

**Hygiene**
- **Upgrade to Windows 10 systems:** Researchers predominantly found the victims to be a mix of XP, Windows 7 and Windows 2008 and 2003 servers. There were a handful of Windows 2012 servers, and even less Windows 8 endpoints.
- **Make sure patches are up to date:** As always, many threats can be mitigated simply by identifying unpatched systems and deploying the appropriate fixes. This is a key element of CIS Controls #2 for Software Inventory and #3 for Continuous Vulnerability Management.
- **Add network segmentation rules:** If endpoints don’t normally talk to each other, then it is a good practice to restrict that communication from happening. This can be achieved by adding rules on the firewall and leveraging proper network segmentation.
- **Upgrade any IIS v7.5 in your environment:** This threat actor leveraged this specific web server version for all their back-end collection infrastructure, which is the default IIS version that comes included in Windows 2008 R2 servers. It’s possible they were able to take advantage of a known vulnerability in that version.
Supporting Evidence of Access Mining

The components of Access Mining can be further broken down into detailed steps by looking at the campaign investigated. TAU’s analysis of the Smominru / MyKings campaign highlights the intricacy of the various aspects of their malware, and how verbose they are with their overall campaign. The key steps they took to execute this campaign and the supporting evidence discovered by the TAU team are detailed below.

Primary Infection Vector:
- EternalBlue Scanning
- and Exploitation

Tertiary Infection Vectors:
- Drive-By Downloads
- Watering Hole
- Attacks Phishing

Invoke persistence via WMI
Download l.txt
Download up.txt

Download and execute s.ps1
Collects host information and credentials
Uploads data to FTP server

Download and execute l.txt
Kill processes listed in l.txt

Download and execute up.txt

Data Uploaded to FTP
Middleman Server

Data migrated off to second stage server

Notes Added to Botnet

Credentials / RAT for Sale

Remote Access Marketplaces

Cybercriminals

High Value Assets Identified

XX

C:]
**Initial Infection**

The investigation by TAU started with a prior infection, but based on existing research on the Smominru campaign, it is likely that initial infection occurred via phishing, watering hole attacks, drive-by downloads, and proliferated further via EternalBlue scanning and exploitation.

**PowerShell Execution**

PowerShell downloads and invokes first-stage payloads, downloading multiple executables and invoking various persistence and reconnaissance functions directly in memory.

**DNS Poisoning**

DNS is modified to route traffic to unsolicited domains, making analysis more difficult, masking aspects of the C2, and allowing for dynamic updates going forward.
Malware Spreads and Mines

Malware pulls down a modified version of XMRig and mines Monero, a popular privacy coin. This activity commences following 14 hours of inactivity on the system, primarily targeting Windows Servers, whereas data harvesting affects both.

Setting the Stage

The malware pulls down a list of other miners and proceeds to terminate all competing cryptomining processes via taskkill. From there, the malware modifies permissions of various directories, disables all SMB and NetBIOS ports on the local firewall, and establishes persistence via RegSvr32 (MITRE T1117).
Data Collection

Key PowerShell script (up.txt) collects data such as external IP, internal IP, credentials, various host information and OS fingerprinting data.

Exfiltration

Mimikatz is then used to scrape credentials and the data is uploaded via FTP to a third-party staging server.

Data to Access Marketplace

There are multiple paths that these exfiltrated credentials and embedded remote access capabilities can be leveraged, both by the botnet operators directly, or sold on one of the many dark web access marketplaces.
Access Mining Signals a New Norm for Cybersecurity

The existence of Access Mining forces cybersecurity professionals to alter thinking and processes to deal with the potential of commodity malware posing more of a risk than anticipated. This case has demonstrated how a commodity threat actor can quickly evolve tooling to add new dimensions to their business model and pose significant risk. Additionally, this investigation proves the importance of behavioral monitoring. Had the CB ThreatSight team not been monitoring behaviors across the customer base, they would not have noticed the unusual mix of tactics and techniques at play masked by a commodity cryptominer.

Commodity Malware Will Evolve Rapidly
Thanks to the availability of open source exploits and tooling, commodity malware will continue to evolve rapidly to take advantage of additional revenue opportunities.

Commodity Malware Risk Increased
Commodity malware, like cryptominers, can pose a higher risk to organizations and need to be prioritized for removal and investigated for signs of Access Mining.

Behavioral Monitoring Is Critical
Focusing on behaviors and having the tools to spot unusual trends will be critical for cybersecurity professionals moving forward in the ever-evolving threat landscape.
Smominru
- https://securelist.com/blog/research/77621/newish-mirai-spreader-poses-new-risks/
- https://blogs.yahoo.co.jp/fireflyframer/34858380.html
- https://www.reddit.com/r/antivirus/comments/6maxrt/tenacious_malware_called_ismolsmo/
- https://isc.sans.edu/forums/diary/Malicious+Script+Leaking+Data+via+FTP/24484/

MyKings

Trends
- https://coinmarketcap.com/currencies/monero/
- https://en.wikipedia.org/wiki/The_Shadow_Brokers
GREG FOSS

Greg Foss is a Senior Threat Researcher with Carbon Black’s Threat Analysis Unit (TAU) where he focuses on detection engineering, security efficacy, and bypass analysis across the diverse product line. In previous roles, Greg led a Threat Research team, built and ran a Global Security Operations program, consulted in penetration testing, and worked as a security analyst for the federal government. Greg is a very active member of the Denver information security community who loves to give back and support the industry.

MARINA LIANG

Marina Liang is a Tier II Threat Analyst under Carbon Black’s Managed SOC arm, CB ThreatSight, where she focuses on threat hunting, analyzing new and existing attacks and bypasses, and enhancing security efficacy and detection. Marina helped lead and develop the threat hunting operations as the first Tier II analyst on the CB ThreatSight team. In a previous role, Marina assisted customers in deploying, configuring and tuning Carbon Black’s product line.
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