27th ANNUAL FIRST CONFERENCE BERLIN
14-19 JUNE 2015

mnemo SECURITY

Cyber Security Challenges in the Financial Sector:

Internal and External Threats

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Internal and External Threats

Agenda

- About...
- Why do we have to be worried?
- First story: The crazy cash machine
- Second story: Cyber Bonnie and Clyde
- Conclusions
- Questions & answers
- Contact information

About...

What is Mnemo?

- Founded in **2000**
- Privately held **Spanish** company
- Headquarters in **Madrid, Spain**
- More than **1,000** employees
- Operations in twelve countries including **Mexico, Colombia and Saudi Arabia**
- Annual sales totaling **100 million dollars**
- More than **100 customers** of the following sectors:
  - Public Utilities
  - Government
  - Finance & Banking
  - Industry
  - Oil & Gas

Goals

- Talking about the danger of the information security incidents for the private sector.
- Talking you stories from real world not from surveys or estimations
- Making aware everybody about deep incidents investigation and more information control

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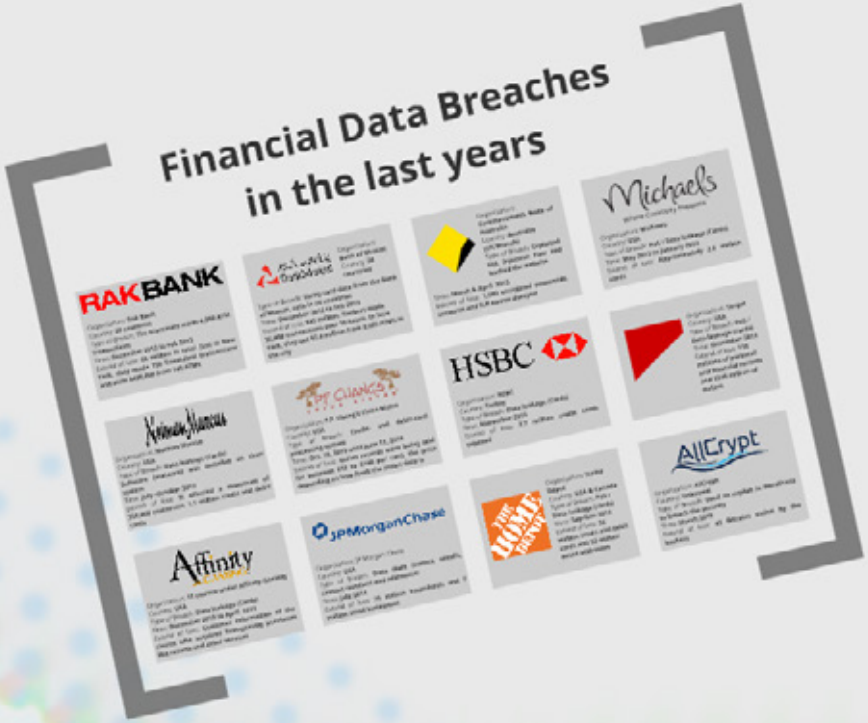
Why do we have to be worried?



Financial Data Breaches in the last years

Organization: **Rak Bank**
Country: **20 countries**
Type of Breach: **The scammers made 4,500 ATM transactions**
Time: **December 2012 to Feb 2013**
Extend of loss: **$5 million in total. Just in New York, they made 750 fraudulent transactions and stole $400,000 from 140 ATMs**

Organization: **Bank of Muscat**
Country: **24 countries**
Type of Breach: **Using card data from the Bank of Muscat, cells in 24 countries**
Time: **December 2012 to Feb 2013**
Extend of loss: **$45 million. Hackers made 36,000 transactions over 10 hours. In New York, they got $2.4 million from 3,000 ATMs in the city**

Organization: **Commonwealth Bank of Australia**
Country: **Australia (UK Branch)**
Type of Breach: **Exploited SQL Injection flaw and hacked the website**
Time: **March & April 2013**
Extend of loss: **1,900 encrypted passwords, accounts and full names dumped**

Organization: **Michaels**
Country: **USA**
Type of Breach: **PoS / Data leakage (Cards)**
Time: **May 2013 to January 2014**
Extend of loss: **Approximately 2.6 million cards**

Organization: **Neiman Marcus**
Country: **USA**
Type of Breach: **Data leakage (Cards)**
Software (malware) was installed on their system
Time: **July -October 2013**
Extend of loss: **It affected a maximum of 350,000 customers. 1.1 million credit and debit cards**

Organization: **P.F. Chang's China Bistro**
Country: **USA**
Type of Breach: **Credit- and debit-card-processing system**
Time: **Oct. 19, 2013 until June 11, 2014**
Extend of loss: **Stolen records were being sold for between $18 to $140 per card, the price depending on how fresh the stolen data is**

Organization: **HSBC**
Country: **Turkey**
Type of Breach: **Data leakage (Cards)**
Time: **November 2013**
Extend of loss: **2.7 million credit cards exposed**

Organization: **Target**
Country: **USA**
Type of Breach: **PoS / Data leakage (cards)**
Time: **November 2013**
Extend of loss: **110 millions of personal and financial records and $248 million of dollars**

Organization: **11 casinos under Affinity Gaming**
Country: **USA**
Type of Breach: **Data leakage (Cards)**
Time: **December 2013 to April 2014**
Extend of loss: **Customer information of the clients who acquired Non-gaming purchases like resorts and other services**

Organization: JP Morgan Chase
Country: **USA**
Type of Breach: **Data theft (names, emails, contact numbers and addresses)**
Time: **July 2014**
Extend of loss: **76 million households and 7 million small businesses**

Organization: **Home Depot**
Country: **USA & Canada**
Type of Breach: **PoS / Data leakage (cards)**
Time: **Sep-Nov 2014**
Extend of loss: **56 million credit and debit cards and 53 million email addresses**

Organization: **AllCrypt**
Country: **Unknown**
Type of Breach: **Used an exploit in WordPress to breach the security**
Time: **March 2015**
Extend of loss: **42 Bitcoins stolen by the hackers**

HSBC

Organization: **HSBC**
Country: **Turkey**
Type of Breach: **Data leakage (Cards)**
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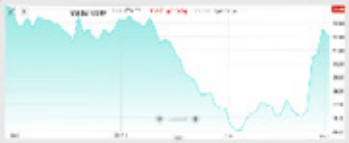
Small Analysis

TARGET

This chain of supermarkets had a good run at the New York Stock Exchange in late 2013

Was it because of January?



In January 2014, when it was unveiled that the financial information of 110 million customers of Target had been compromised, the company's shares plummeted

I wish it was only January

Throughout 2014, Target could not raise the value of their shares significantly, they had to spend a whole year to observe a remarkable recovery

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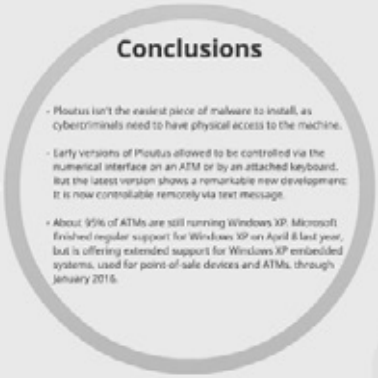


Starring

(Cyber-maloso)
Hacker

George
(Insider)

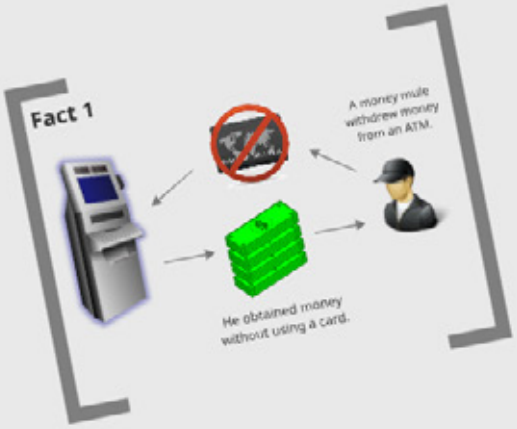
Money mule

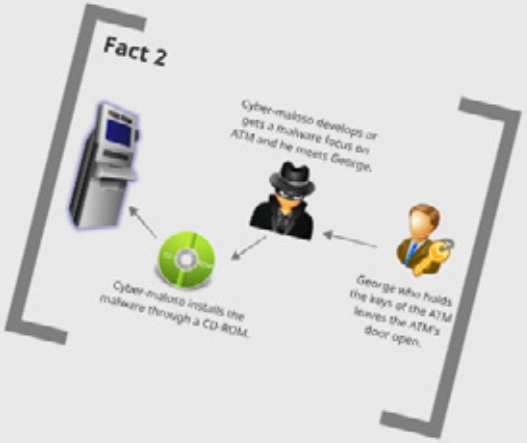
Head of
Fraud
Management

Investigator

Bank (ATM)

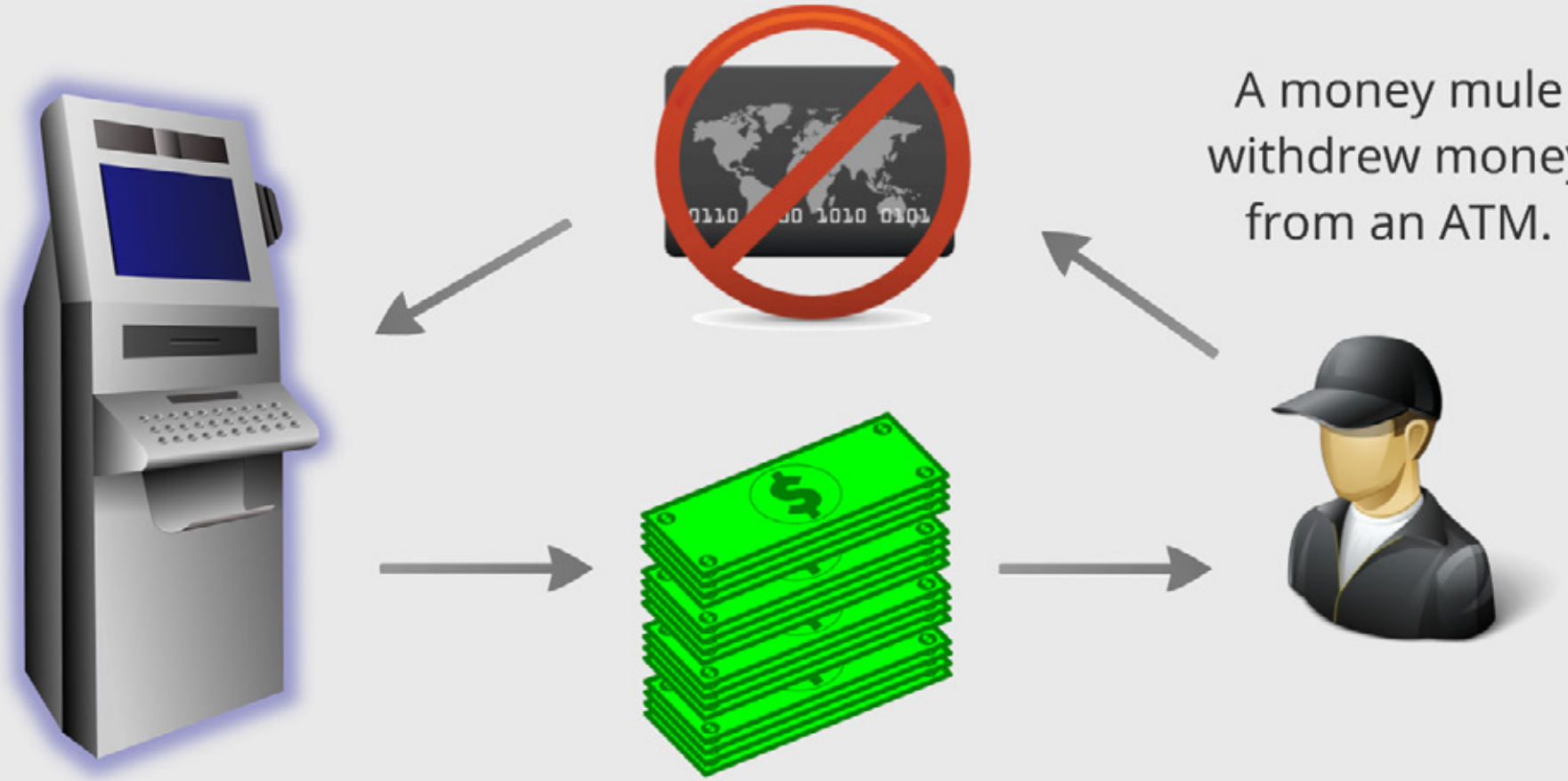
Facts


Fact 1
A money mule withdrew money from an ATM.
He obtained money without using a card.


Fact 2
Cyber-malxso develops or gets a malware focus on ATM and he meets George.
Cyber-malxso installs the malware through a CD-ROM.
George who holds the keys of the ATM leaves the ATM's door open.


Fact 3
Fraud management department recieved a security alert and looked at security cameras.
Head of Fraud Management collects the CD and starts an investigation.

Fact 1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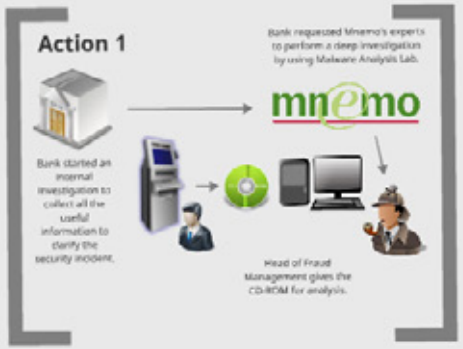
Actions


Action 1
Bank started an internal investigation to collect all the useful information to clarify the security incident.
Bank requested Mnemo's experts to perform a deep investigation by using Malware Analysis Lab.
mnemo
Head of Fraud Management gives the CD-ROM for analysis.


Action 2: Static analysis
Mnemo's Analyst
Static analysis showed up the following results:


Action 3: Dynamic analysis
Mnemo's investigators

Action 1

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Action 2: Static analysis

Mnemo's Analyst

Static analysis showed up the following results:

Finding 1

Ploutus is installed by inserting a CD boot disk which includes a **start.bat** file that does the following:

- Identify the CD drive and the file system directory
- Create NCRDRVPS registry key to install PloutusService.exe
- Copy several libraries (APTRA) and ploutusservice.exe file to Windows directory

Nombre	Fecha de modifica...	Tipo	Tamaño
I386	16/06/2014 12:29 ...	Carpeta de archivos	
Programs	16/06/2014 12:29 ...	Carpeta de archivos	
PLOUTUS2014.EXE	11/03/2014 10:10 ...	Aplicación	72 KB
WIN51IP	16/06/2014 12:29 ...	Archivo	0 KB
BOOTFONT.BIN	14/04/2008 07:00 a...	Archivo BIN	5 KB
START.BAT	11/03/2014 10:18 ...	Archivo por lotes ...	37 KB
WIN51IP.SP3	16/06/2014 12:29 ...	Archivo SP3	0 KB
CDROM.TXT	21/07/2013 11:20 ...	Documento de tex...	1 KB
lista.txt	29/05/2014 04:32 ...	Documento de tex...	9 KB
AFAInterfaces.dll	07/01/2011 08:46 a...	Extensión de la apl...	45 KB
ApplicationCore.dll	07/01/2011 08:20 a...	Extensión de la apl...	2,865 KB
AWCODC32.DLL	17/06/1998 11:00 ...	Extensión de la apl...	24 KB
AWDCXC32.DLL	17/06/1998 11:00 ...	Extensión de la apl...	6 KB
AWDENC32.DLL	17/06/1998 11:00 ...	Extensión de la apl...	12 KB
AWRESX32.DLL	29/10/1999 02:38 ...	Extensión de la apl...	26 KB
AWVIEW32.DLL	17/06/1998 11:00 ...	Extensión de la apl...	10 KB
BarcodeReader.dll	14/07/2009 02:12 ...	Extensión de la apl...	38 KB
BNACloseState.dll	14/07/2009 02:53 ...	Extensión de la apl...	221 KB
BNAErrorRecovery.dll	14/07/2009 02:53 ...	Extensión de la apl...	153 KB
BNAEventMonitor.dll	14/07/2009 02:53 ...	Extensión de la apl...	148 KB
BNAReconfigureCassettes.dll	14/07/2009 02:54 ...	Extensión de la apl...	46 KB
BNAStartOfDay.dll	14/07/2009 02:53 ...	Extensión de la apl...	201 KB
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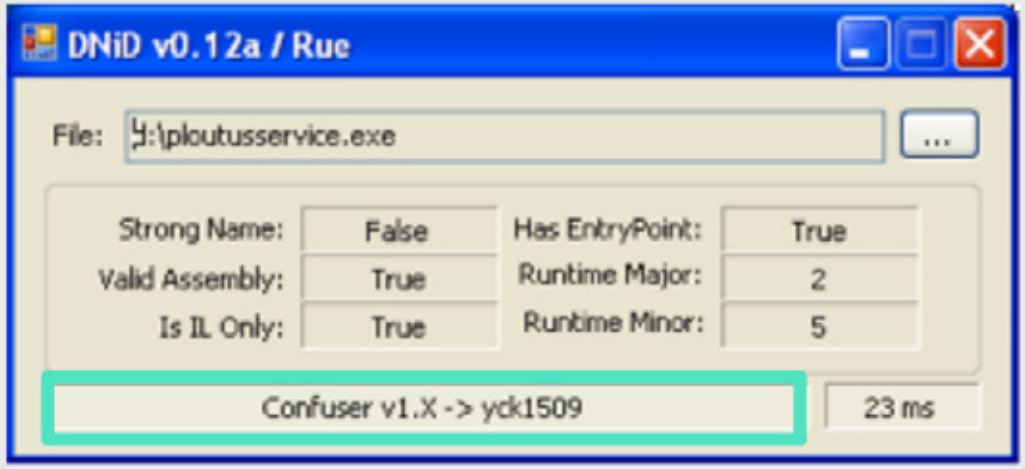
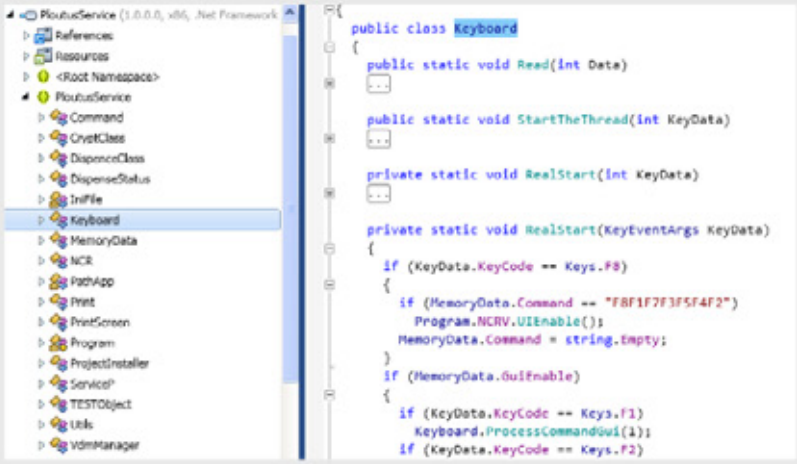
Finding 2

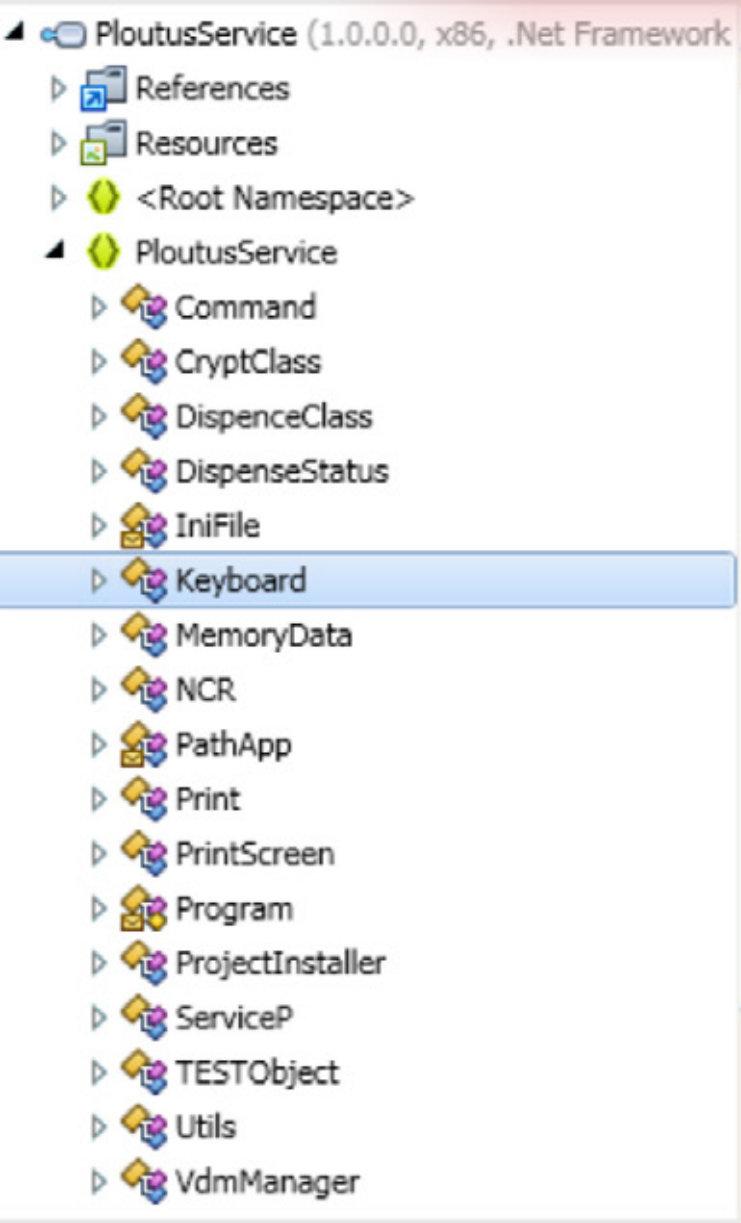
Ploutusservice.exe file is a portable executable 32 .NET assembly and it is **obfuscated** with Confuser v1.9.0.0 which is an **anti-debugger** and **encrypts codes**.



Finding 3

- The key sequence to launch the application is **F8 F1 F7 F3 F4 F2 F8**.
- The malware requires an activation code that is generated based on **the day, month and a random four-digit number** which is stored in C:\Windows\Config.ini file after pressing F1 key.
- If the activation code is correct and the vendor is identified, the thief can dispense the money with F3 key. This activation code is valid for 24 hours.
- All the activities are recorded in C:\Windows\System32\log.txt file






```
{
  public class Keyboard
  {
    public static void Read(int Data)
    ...

    public static void StartTheThread(int KeyData)
    ...

    private static void RealStart(int KeyData)
    ...

    private static void RealStart(KeyEventArgs KeyData)
    {
      if (KeyData.KeyCode == Keys.F8)
      {
        if (MemoryData.Command == "F8F1F7F3F5F4F2")
          Program.NCRV.UIEnable();
        MemoryData.Command = string.Empty;
      }
      if (MemoryData.GuiEnable)
      {
        if (KeyData.KeyCode == Keys.F1)
          Keyboard.ProcessCommandGui(1);
        if (KeyData.KeyCode == Keys.F2)
```

Finding 4

The procedure for generating the correct activation code is as follows:

1. Press F1 key to generate a random number.
2. Look for the random number stored in the C:\Windows\Config.ini file (DATAA)
3. Get the system date
4. Use the CryptTrack algorithm located in CryptClass, passing as inputs previous obtained values.
5. Use AddCero function to generate a string of 8 digits and select the activation code on the app.
6. Press F2 key to active the ATM, and **the generated code should be working!!!**

```
else if (CMD == 2)
{
  Utils.UpdateLog("Activate");
  if (MemoryData.ActivatedID == Utils.AddCero(CryptClass.CryptTrack(now.Day, now.Month, int.Parse(s)).ToString()))
  {
    if (CryptClass.GetMd5Hash(MemoryData.ActivatedID) != IniFile.IniReadValue("Config", "DATAC"))
    {
      TimeSpan span = (TimeSpan) (DateTime.UtcNow - new DateTime(0x7b2, 1, 1, 0, 0, 0));
      IniFile.IniWriteValue("Config", "DATAB", span.TotalSeconds.ToString());
      IniFile.IniWriteValue("Config", "DATAC", CryptClass.GetMd5Hash(MemoryData.ActivatedID));
      Program.NCRV.UpdateText("ATM:OK DATE:" + DateTime.Now);
      Utils.UpdateLog("ACTIVATE OK");
    }
    else
    {
      Program.NCRV.UpdateText("ATM:ALEADY ACTIVE DATE:" + DateTime.Now);
      Utils.UpdateLog("ACTIVATE ALREADY");
    }
  }
  else
  {
    Program.NCRV.UpdateText("ATM:INVALID ACTIVATION CODE DATE:" + DateTime.Now);
    Utils.UpdateLog("ACTIVATE INVALID");
  }
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      IniFile.IniWriteValue("Config", "DATAB", span.TotalSeconds.ToString());
      IniFile.IniWriteValue("Config", "DATAC", CryptClass.GetMd5Hash(MemoryData.ActivatedID));
      Program.NCRV.UpdateText("ATM:OK DATE:" + DateTime.Now);
      Utils.UpdateLog("ACTIVATE OK");
    }
    else
    {
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      Utils.UpdateLog("ACTIVATE ALREADY");
    }
  }
  else
  {
    Program.NCRV.UpdateText("ATM:INVALID ACTIVATION CODE DATE:" + DateTime.Now);
    Utils.UpdateLog("ACTIVATE INVALID");
  }
```

Action 3: Dynamic analysis

Mnemo's Investigators

Installation

• Ploutus is installed by inserting a bootable Windows CD-ROM from the original Windows XP that means you **need physical access**.

Execution

We executed a key sequence **F8 F1 F7 F3 F4 F2 F8**, which was obtained during code analysis, to initiate the malicious application.

GUI can be manipulated using keyboard with the following keys:

- F1: Generate ID
- F2: Active ATM
- F3: Dispenser
- F4: Disable GUI
- F5: Up key
- F6: Down key
- F7: Right key
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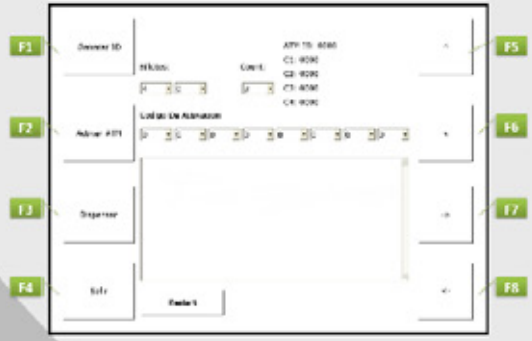


F1

Generar ID

F2

Activar ATM

F3

Dispensar

F4

Salir

Billetes:

4 0

Count:

3

ATM ID: 0000

C1: 0000

C2: 0000

C3: 0000

C4: 0000

Codigo De Activacion

0 0 0 0 0 0 0 0

Restart

F5

^

F6

v

F7

->

F8

<-

Generar ID

Billetes:

Count:

4 0 3

ATM ID: 5482

C1: 0000

C2: 0000

C3: 0000

C4: 0000

Random number

Codigo De Activacion

0 0 0 2 0 5 5 1

Activation code

If (MemoryData.ActivatedID == Utils.AddCero(CryptClass.CryptTrack(now.Day, now.Month, int.Parse(s)).ToString()))

Activate Receive
ATM:OK DATE:15/10/2013 3:15:10 PM
Dispense Receive
Dispense Bill:40 Count:3
DISPENSE START BILL:40 DATE:15/10/2013 3:15:29 PM
Vendor Init OK
Vendor Mode:XFS_AVAILABLE
System Mode: VDM_NORMAL
vdm_AvailabilityChanged:15/10/2013 3:15:30 PM Status:XFS_AVAILABLE
vdm_EntryRequested:15/10/2013 3:15:30 PM

Successful activation

Dispensar

Salir

Restart

^

v

->

<-

Conclusions

- Ploutus isn't the easiest piece of malware to install, as cybercriminals need to have physical access to the machine.
- Early versions of Ploutus allowed to be controlled via the numerical interface on an ATM or by an attached keyboard. But the latest version shows a remarkable new development: It is now controllable remotely via text message.
- About 95% of ATMs are still running Windows XP. Microsoft finished regular support for Windows XP on April 8 last year, but is offering extended support for Windows XP embedded systems, used for point-of-sale devices and ATMs, through January 2016.

Second story: Cyber Bonnie and Clyde

Starring

Cyber-Bonnie

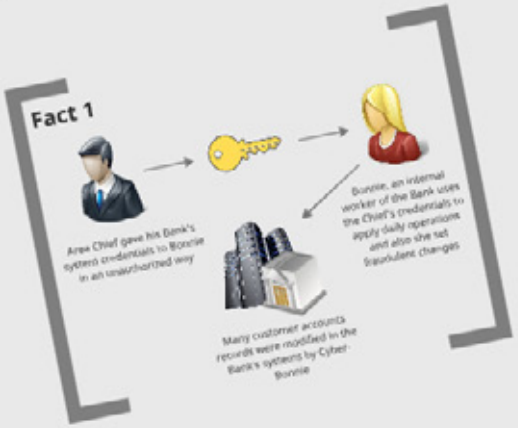
Cyber-Clyde

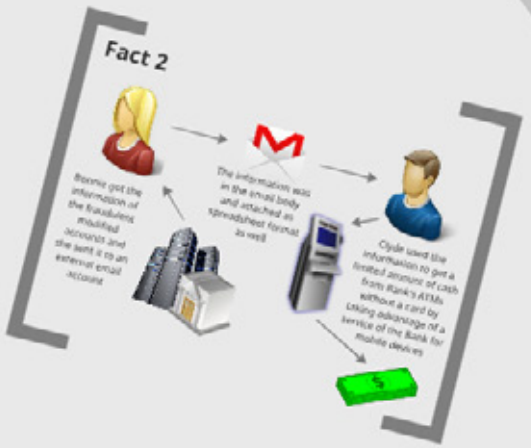
Area Chief

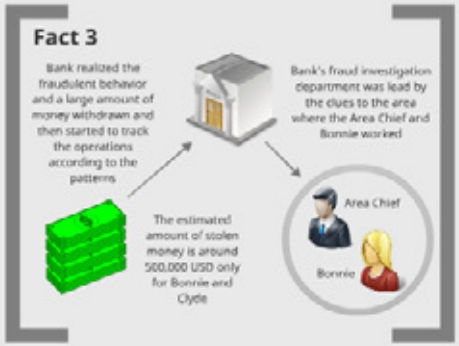
Investigator

Bank

Facts


Fact 1
Area Chief gave his Bank's system credentials to Bonnie in an unauthorized way
Bonnie, an internal worker of the Bank uses the Chief's credentials to apply daily operations and also she set fraudulent changes
Many customer accounts records were modified in the Bank's systems by Cyber - Bonnie


Fact 2
Bonnie got the information of the fraudulent modified accounts and she sent it to an external email account
The information was in the email body and attached as spreadsheet format as well
Clyde used the information to get a limited amount of cash from Bank's ATMs without a card by taking advantage of a service of the Bank for mobile devices


Fact 3
Bank realized the fraudulent behavior and a large amount of money withdrawn and then started to track the operations according to the patterns
Bank's fraud investigation department was lead by the clues to the area where the Area Chief and Bonnie worked
The estimated amount of stolen money is around 500,000 USD only for Bonnie and Clyde
Area Chief
Bonnie

Fact 1

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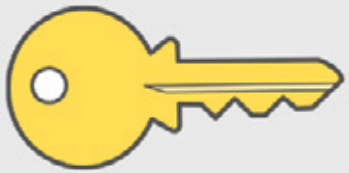
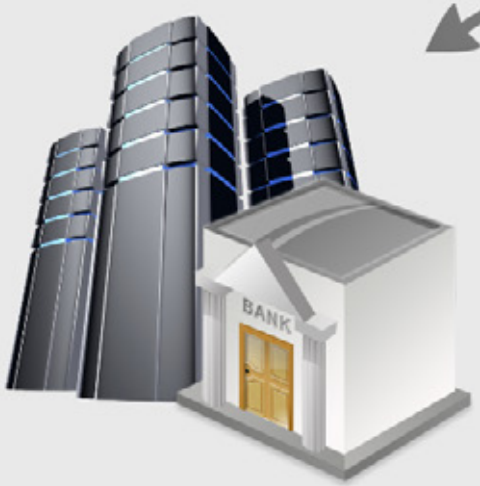


Bonnie, an internal worker of the Bank uses the Chief's credentials to apply daily operations and also she set fraudulent changes



Many customer accounts records were modified in the Bank's systems by Cyber-Bonnie

Fact 2

Bonnie got the information of the fraudulent modified accounts and she sent it to an external email account

The information was in the email body and attached as spreadsheet format as well

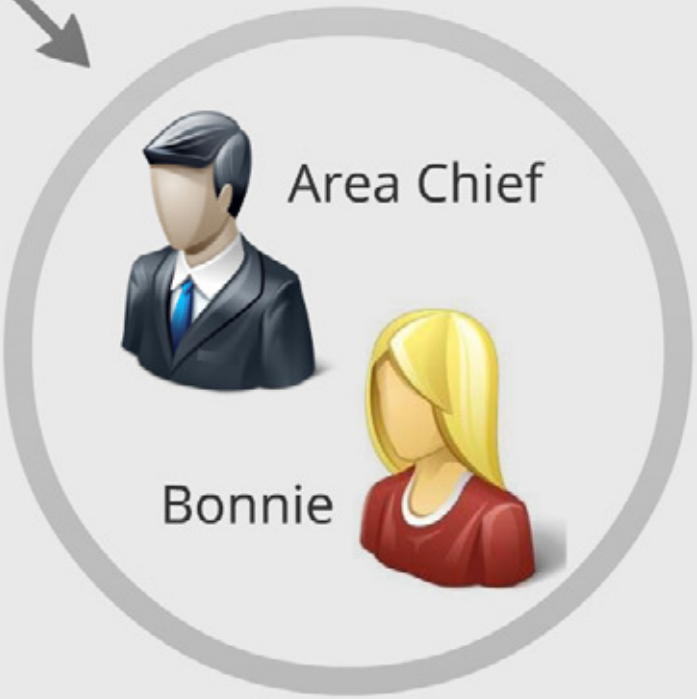
Clyde used the information to get a limited amount of cash from Bank's ATMs without a card by taking advantage of a service of the Bank for mobile devices

Fact 3

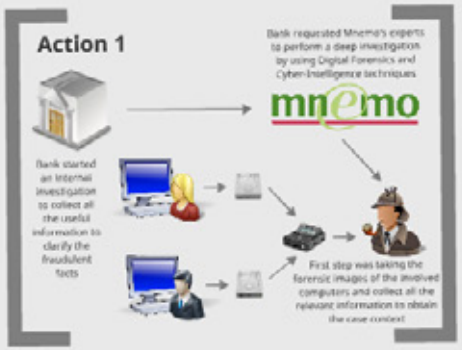
Bank realized the fraudulent behavior and a large amount of money withdrawn and then started to track the operations according to the patterns

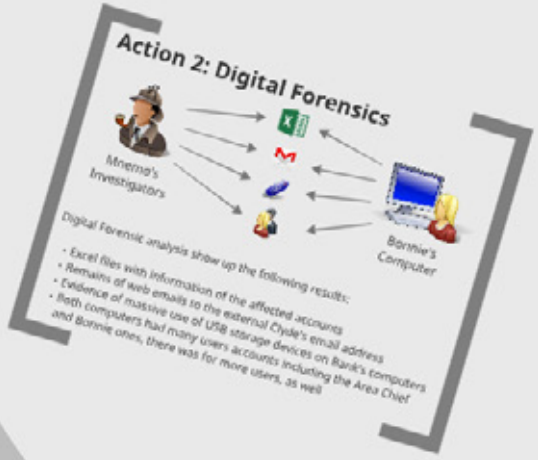
Bank's fraud investigation department was lead by the clues to the area where the Area Chief and Bonnie worked

The estimated amount of stolen money is around 500,000 USD only for Bonnie and Clyde



Actions


Action 1
Bank requested Mnemo's experts to perform a deep investigation by using Digital Forensics and Cyber-Intelligence techniques
mnemo
Bank started an internal investigation to collect all the useful information to clarify the fraudulent facts
First step was taking the forensic images of the involved computers and collect all the relevant information to obtain the case context


Action 2: Digital Forensics
Mnemo's Investigators
Bonnie's Computer
Digital Forensic analysis show up the following results:
• Excel files with information of the affected accounts
• Remains of web emails to the external Clyde's email address
• Evidence of massive use of USB storage devices on Bank's computers
• Both computers had many users accounts including the Area Chief and Bonnie ones, there was for more users, as well


Action 3: Cyber-Intelligence
Internet
Phishing Domains
• Cyber Intelligence findings resulted quite interesting, because the external Clyde's email address was involved with many phishing Domains, some active and others disabled
• Besides, Clyde's and Bonnie's Facebook profiles were found for both and we realized they were very related, they were spouses

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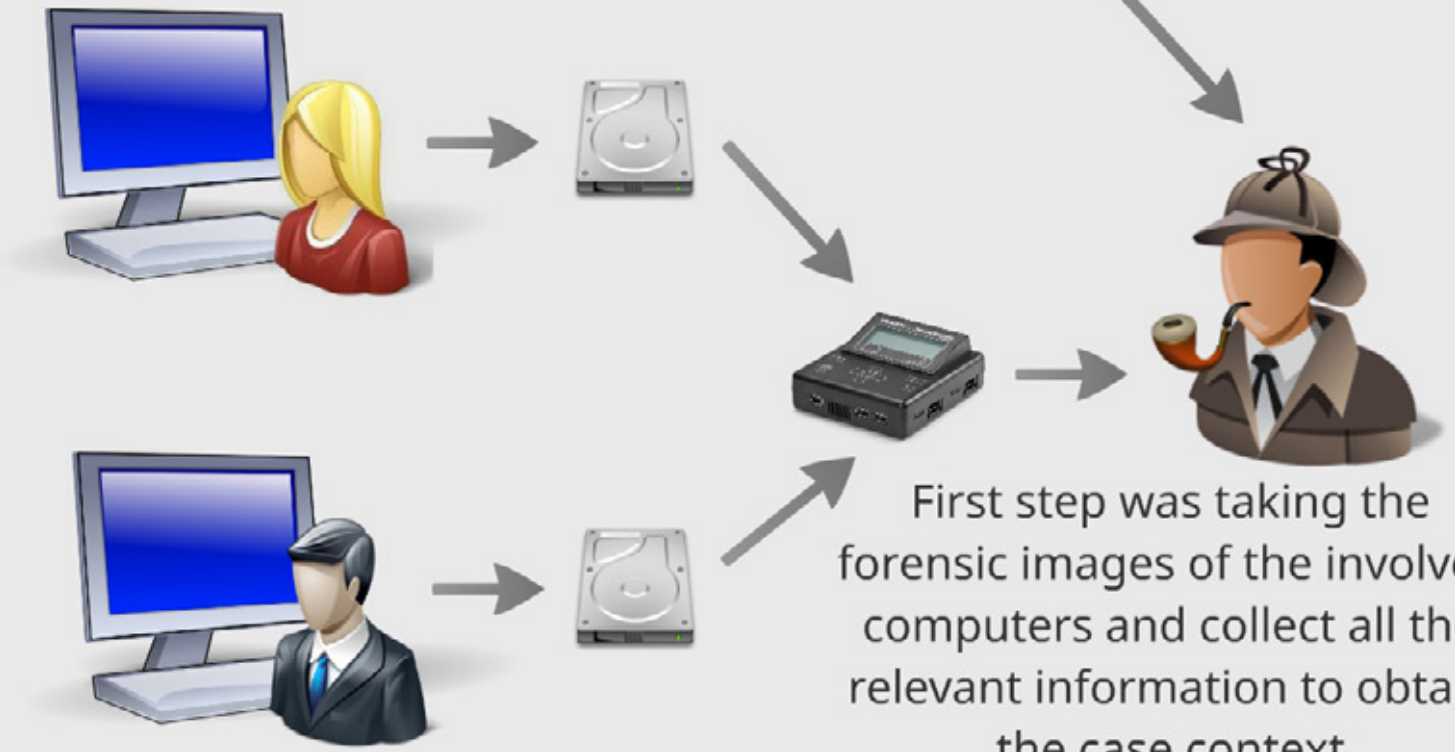

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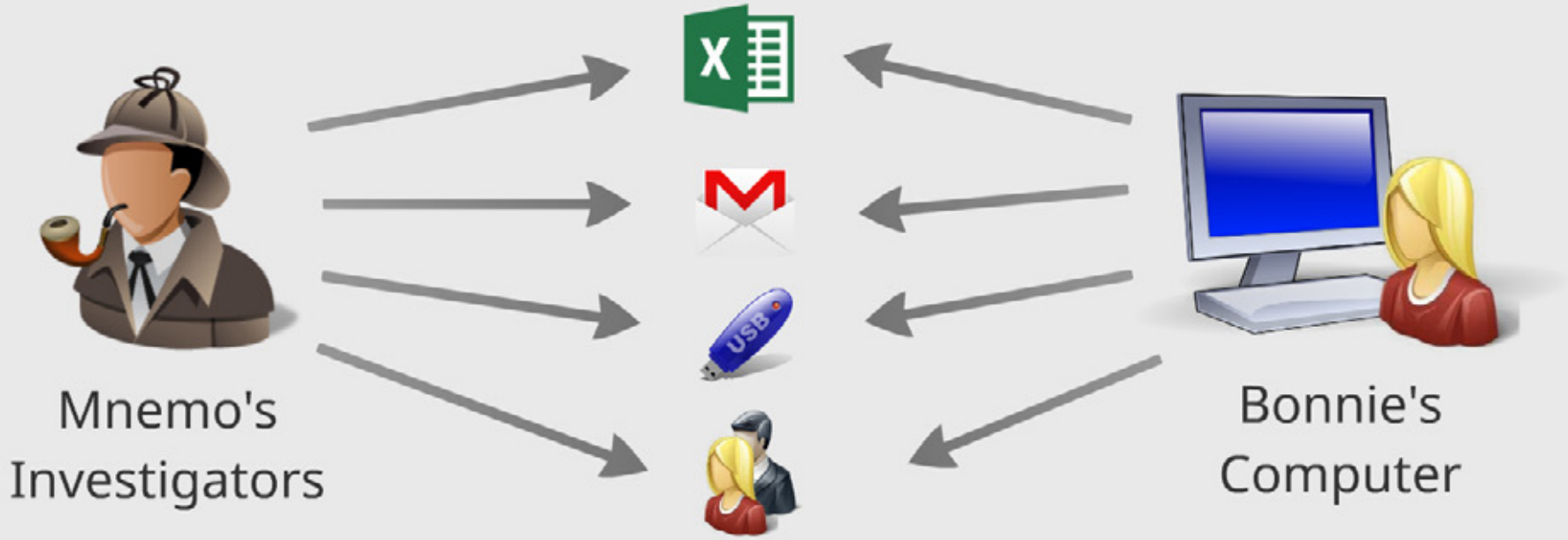

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Mnemo's Investigators

External Clyde's email address

Internet

Phishing Domains

Clyde's Facebook

Bonnie's Facebook

- Cyber-Intelligence findings resulted quite interesting, because the external Clyde's email address was involved with many Phishing Domains, some active and others disabled
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Conclusions

- It is really worrying and disturbing that one of them was related with Phishing Domains, because this fact could mean that cyber criminals are now getting into the institutions and that they are starting to work with more knowledge and organization.

- Due to the lack of well implemented internal security policies, the Bank could not take this case to the court, despite the good practices that Mnemo followed to preserve the digital evidence and the results of the investigation.

Conclusions

Continuing challenges

- Cybercriminals are inside organizations.
- Organizations are not prepared to handle this type of security incidents.
- They failed by not having appropiate protocols for the new type of probe new ways of attacks, and cybergangs.

Advice based on experience

- Don't work alone.
- Address the problem through a global approach.
- Start with a simple-to-complex tasks.
- Be more aware of the growing cybersecurity threats.
- Monitor the evolution of existing and emerging technologies.
- Take advantage of the information-sharing resources available.

To finish...

- Cybercrime is global, it has no borders or timezones... we have to face it with a different approach.
- Organizations need to:
  - change their structures
  - quickly responde to new types of crimes
  - create a position as head of intelligence, risk assessment officer
  - collaborate with others CERTs

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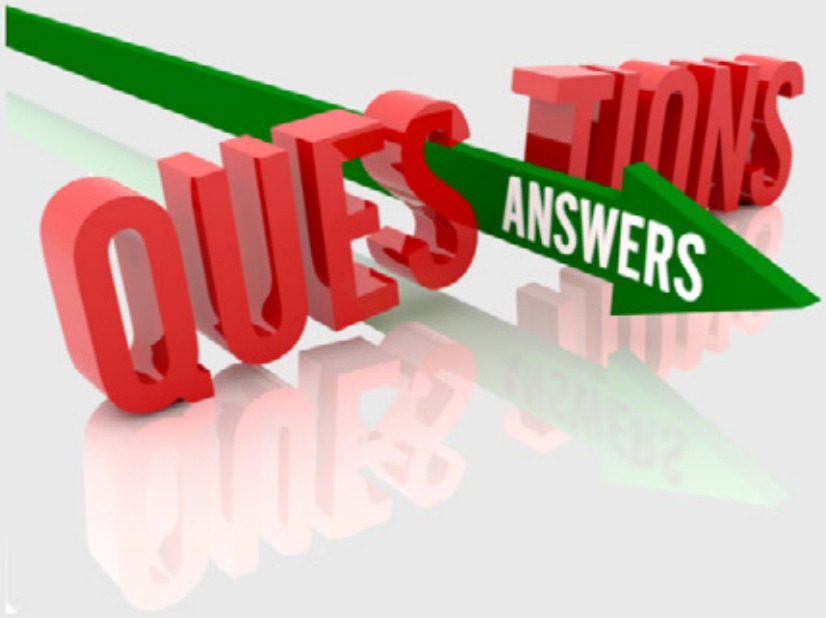
Questions & Answers



Contact Information

Rosa Xochitl Sarabia Bautista

Director of Mnemo-CERT

rx.sarabia@mnemo.com

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