Mobiles workstations *in*security... Mitigating crawling trojans

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Agenda

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What is this all about ?

Remote access to central Information System (IS)

- Fashionable marketing concept
- Ability to get a "home-like" connection
- Connect from various terminals (laptop, PDA, phone, etc.)
- Connect from many places (home network, office, WiFi hotspot, etc.)

Terminals, connections and technical means are available to make all this possible

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Access means

One can access valuable IS ressources through

- Webified access to ressources : email, files, etc.
- SSL VPN : clientless port redirection (à la SSH)
- Classical VPN stuff : full IP through secured tunnel

Thoses access can be secured

- Authentication (OTP, RSA sigs, x509)
- Privacy (chiphering)

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SSL VPN focus

SSL VPN is a so called clientless VPN solution
Can provide from simple web portal to full IP tunneled access

Issues

- Port redirection requires local code execution (Java, ActiveX) : many solutions requires IE
- DNS overwrite to localhost requires privileged access (hosts file overwrite)
  $\Longrightarrow$ IE + Admin : win-win situation ?
- Full IP trafic tunneling requires dedicated client to provide PPP over SSL

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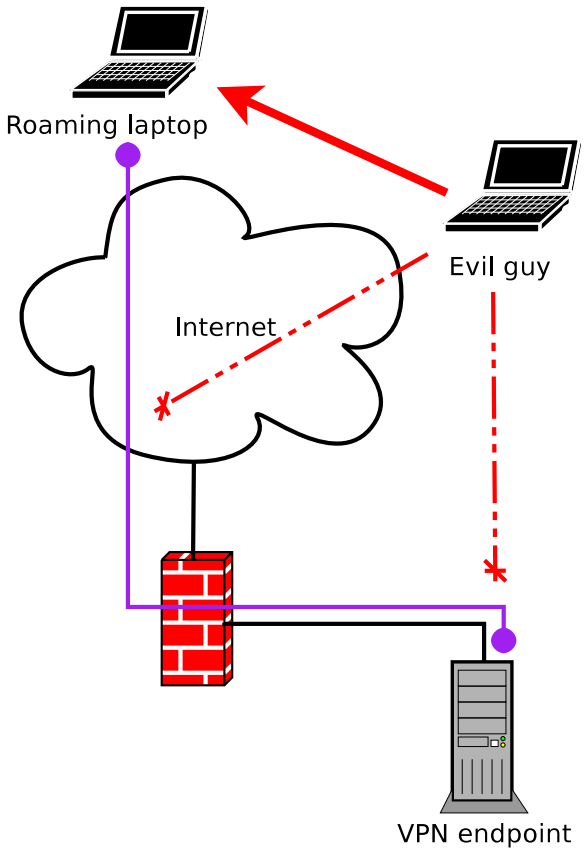
So what ?

Thoses links are secure, but...

The endpoint problem

Is roaming endpoint fully trustable ?
What if mobile station is compromised ?



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Mobile user vs. Information system

Remotly connect a mobile user to central IS

- Mobile workstation specifics
- Environment specifics

Theses specifics raises security issues

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Mobile workstation

A mobile workstation is an interesting target

- Is physically available
- Is connected to the network
- Has access to critical ressources
- Is operated by a *(l)user*

Regular workstation vs. mobile workstation

Mobile workstation only relies on its own protection means

Regular workstation

- Physically protected
- External network protection
- Local antivirus
- Personal firewall
- Automatic updates

Mobile workstation

- No physical protection
- No network protection
- Local antivirus (updates ?)
- Personal firewall
- No updates when offline

Mobile station exposure

Mobile workstations (laptops) are far more exposed than regular workstations (desktops)

Question

Would you let a bunch of desktops directly connected to the Internet a full day and put them back into LAN just like this ?

$\Longrightarrow$ That's however the case with most laptops configuration...

Physical issues

Laptops, PDAs and other mobile devices are easy to steal.

- Sensible data
- Credentials (logon cache, passwords storages, configuration files, etc.)
- Preconfigured access to IS through VPN

PDA and portable storage are weak against physical access...

Environmental issues

A mobile station is often connected to an insecure environment

- Unknown LAN, e.g. Cyberbase, home network, etc.
- WLAN, e.g. hotspot, WEP *"protected"* home network, etc.

Thoses environment can be compromised...

Remote access

Do you trust the system connecting to your VPN ?

- Home workstation : can be infected or compromised
- Heavily tweaked laptop : is it still secure ?
- Unknown workstation (for clientless ressources)

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Back home

Can you let a mobile station reconnect to IS after a journey outside ?

- Where has it been connected ?
- Is it infected ?
- Is it compromised ?
- Will it infect the whole network ?

Do not forget unknown laptops connecting to your network (e.g. pre-sales needing to download his slides)

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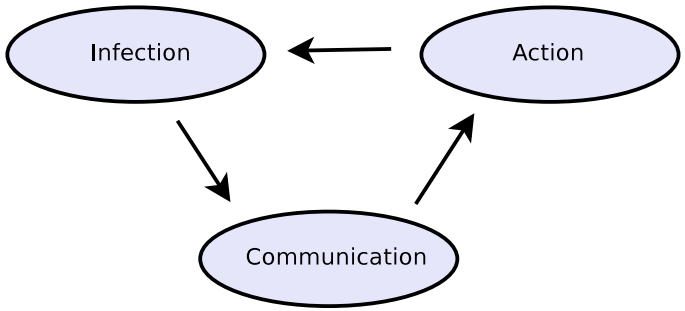
Infection scenario

Information System attack using mobile workstation[1]

Three steps attack :

1. Infection
2. Communication with outter world
3. Action



[1] Thanks to french LCEN law, some mentionned tools may not be available online anymore...

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Infection

The important, but *easy* part...

Attack means

- Physical access
- Direct attack through network
- Malicious traffic injection

Physical access

Information gathering

- Scan hard drive for sensible data
- Find credentials
- Find remote access configuration stuff

Real life example

Hard drive is plugged to another box and scanned

- Batch file contains VPN group password
- VPN group password is stored ciphered, but can be retrieved in memory by using a vulnerable VPN client application
- Domain credentials are brute forced from logon cache

Consequence

Unrestricted remote VPN access to central IS

Physical access

Boot another system when possible through CDROM, USB or network[2]

- Change superuser credentials
- Bypass FS access control
- Access to some protected areas

Consequence

Access to sensible data

[2]Some laptops BIOSes boot from network PXE without asking for password...

Physical access

Attempt to tamper system

- Autorun infection : CDROM, USB key[MAY05], any removable storage
- Network attack : connect cable, assign DHCP, attack
- Firewire attack[DOR04] : tamper system memory
- Execute something from console if available

Consequence

Laptop compromisation, malicious code execution

Real life example

WinXP laptop booted but locked

- PCMCIA Cardbus network adapter insertion
- Adapter is recognized as new connection
- DHCP requests that can be answered
- NetBIOS requests and communication on affected network or 169.254.0.0/16

```
cbr@anduril:~$ sudo tcpdump -i eth0 -n
tcpdump: WARNING: eth0: no IPv4 address assigned
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on eth0, link-type EN10MB (Ethernet), capture size 96 bytes
06:54:21.796332 IP 0.0.0.0.68 > 255.255.255.255.67: BOOTP/DHCP, Request from 00:
01:03:dc:2d:83, length: 300
06:54:26.812788 IP 0.0.0.0.68 > 255.255.255.255.67: BOOTP/DHCP, Request from 00:
01:03:dc:2d:83, length: 300
06:54:34.814723 IP 0.0.0.0.68 > 255.255.255.255.67: BOOTP/DHCP, Request from 00:
01:03:dc:2d:83, length: 300
06:55:56.930198 IP 0.0.0.0.68 > 255.255.255.255.67: BOOTP/DHCP, Request from 00:
01:03:dc:2d:83, length: 300
06:55:56.931675 arp who-has 192.168.2.94 tell 192.168.2.1
06:55:57.001834 IP 192.168.2.1.67 > 192.168.2.94.68: BOOTP/DHCP, Reply, length:
300
06:55:57.931571 arp who-has 192.168.2.94 tell 192.168.2.1
06:55:58.931467 arp who-has 192.168.2.94 tell 192.168.2.1
06:56:00.928677 IP 0.0.0.0.68 > 255.255.255.255.67: BOOTP/DHCP, Request from 00:
01:03:dc:2d:83, length: 300
06:56:00.929059 IP 192.168.2.1.67 > 192.168.2.94.68: BOOTP/DHCP, Reply, length:
300
06:56:09.931168 IP 0.0.0.0.68 > 255.255.255.255.67: BOOTP/DHCP, Request from 00:
01:03:dc:2d:83, length: 300
```

Consequences

Local network link to the station up and running

Network initiation

Laptop may not be connected : wireless links exploitation

- IR stuff : close to physical access
- Bluetooth stuff : efficient against mobile phones
- WiFi stuff : many ways of getting a driver associated
  $\Longrightarrow$ Open rogue AP[MZ04] often successful...

Real life example

WinXP Laptop in testlab with active WiFi adapter

- Open WiFi network creation with rogue AP
- Configure laptop network with DHCP
- Exploit RPC/DCOM flaw[a]
- Admin account creation for RDP connection
- Recub[EOS04] backdoor Win32 port installation

[a] Personal firewall has "local network" exception

Consequence

Laptop compromisation, backdoor installed and active

Laptop connected to hostile environment

Mobile worstation has network access in some untrusted place prone to attacks

- Rogue AP attack
- Rogue DHCP server
- ARP cache poisoning
- DNS spoofing/cache poisoning (Windows)
- Traffic redirection and tampering
- Access to network shares
- Remote vulnerabilities exploitation

Tools : arp-sk[RAY02], rogue AP stuff[MZ04], dnsa[BET03]

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Real life example

Laptop is connected to regular (= insecure) WiFi hotspot (or WEP home network[3])

- Redirect HTTP traffic using ARP stuff
- Hotspot : Web authentication is needed against captive portal $\Longrightarrow$ Tamper HTTP traffic on the fly using local redirection
- Exploit browser vulnerability through malicious content

Tools : rogue AP stuff[MZ04], arp-sk[RAY02], scapy[BIO02]

Consequence

Malicious code is executed with user privileges
Hint : SSL VPN / IE / Admin / Win-win situation...

[3] PSPF like and MAC filtering are easy to bypass

Personal firewall

What about personal firewall if present and active

- Exploit PF vulnerabilities : frag, remote exec, etc.
- *Infamous* "local network" for file sharing exception
- VPN client protection only active when VPN is up
- Can be bypassed

Consequence

In many cases, protection is not so effective[BLA03]...

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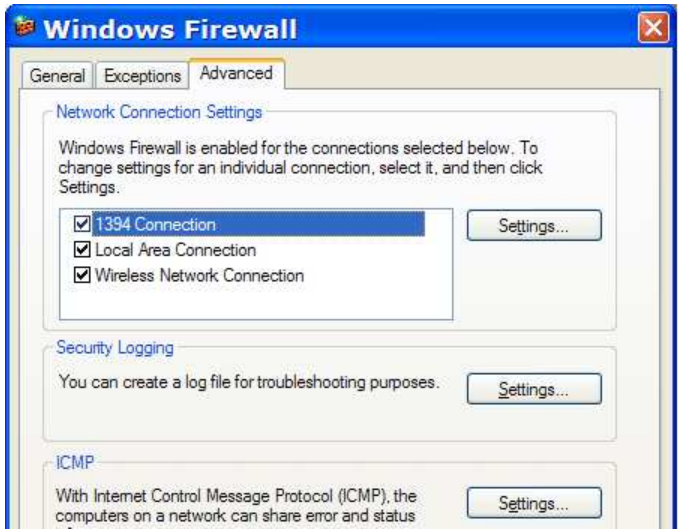

Consequence

In many cases, protection is not so effective[BLA03]...

Malicious code

Backdoor execution

- Backdoor can writen somewhere to filesystem
- Backdoor modifies startup so it will be launched (registry, start menu)
- Backdoor hooks threads running processes (API hooking) and dies

Tools : Casper[DD04], Recub[EOS04]
A bunch of spywares ar no using this kind of technic and are hell to wipe out

Consequence

Laptop compromised : backdoor/trojan active

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Establish communication channel

Backdoor must communicate with outter world, bypassing personal firewall and perimeter protection if present

- Rely on authorized applications
- Trigger communication on specific trafic patterns
- Use native HTTP/HTTPS API so proxy settings and authorization are automagicly used
- Covered channel over HTTP/HTTPS

Tools : Casper[DD04], Recub[EOS04]

Consequence

Backdoor is able to communicate through authorized protocol

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Backdoor actions

Backdoor can execute actions upon request

- Data theft on workstation and shares available on network
- Extension through uploaded modules
- Local privilege escalation
- Scan environment
- Attack other workstations around

Tool : JAB[GRE03]

Backdoor actions

While hooking processes, backdoor can tamper them

- Credentials theft
- Certificates theft
- Network traffic interception
- Etc.

As an example, you can set a fully transparent SSL MiM[DR05]...

Action perimeter

Backdoor can strike from :

- Remote access through VPN
- Information System itself

Asynchronous adaptative backdoor

- Can take actions without communication with its master
- Rely on configured applications so can act from any network
- Can deliver results and upload orders/extensions upon connection

Real life example

Have a look at Blaster worm (summer 2003)[4]...

- Laptops compromised during holidays while connected to Internet
- Worm spreading through VPN when activated
- Worm spreading when connecting back to office LAN (monday sucks syndrom)

Consequence

Supposely immune networks compromised by mobile users

[4] Same situations with Slammer (may 2004)

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Risks mitigation

There's no *off the shelf*, ready to go solution
However, risk can be strongly mitigated

- Workstation physical protection
- Workstation system protection
- Integration within existing architecture
- Information System protection

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Physical protection

Prevent laptop theft if possible, or prevent info gathering from it

- Anti-theft measures : marking, security cables[5]
- Choose appropriate hardware (e.g. security chip for BIOS settings storage)
- BIOS password and boot locked on HDD
- ATA HDD password[6]
- Ciphered storage area

[5] Beware of Bic pen lock picking...
[6] Available since ATA3

System protection

Apply strict security measures

- Choose appropriate OS
- Choose appropriate applications
- Harden configuration : unprivileged accounts, user rights management, updates policy, etc.
- Install security tools : antivirus and personal firewall at least
- Look at new tools : system calls interception, security policy enforcement, etc.

Protect your Information System

Think twice before integrating solution in existing architecture

- Do not treat mobile stations as local stations : they're not equal in term exposure
- Restrict mobile stations access to the system
- See beyond *"DisneyLand style"* commercials ;)

Protect your information system

Enforce network access control

- Avoid uncontroled stations connection
- Control physical acces to your network
- Logical access control to network (e.g. 802.1x)
- Think segmentation and quarantine
  - Dedicated VLANs for guests
  - Manual or automatic[7] workstation checking and quarantine

[7] When available

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Conclusion

Remote access is great, but can ruin the whole IS security.

There's no "off the shelf" solution, but

Mitigation is possible through a strict security policy enforcement

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Greetings

Thanks to...

- **Rstack.org** team
  `http://www.rstack.org/`
- **MISC Magazine**
  `http://www.miscmag.com/`
- **French Honeynet Project**
  `http://www.frenchhoneynet.org/`

Download theses slides from `http://sid.rstack.org/`

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