

# Automata and Formal Languages (10)

Email: christian.urban at kcl.ac.uk

Office: SI.27 (1st floor Strand Building)

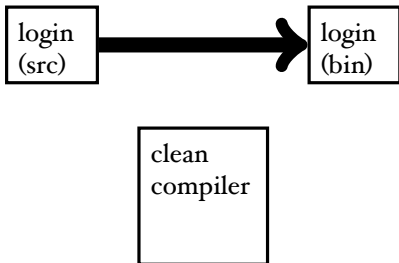
Slides: KEATS (also home work is there)

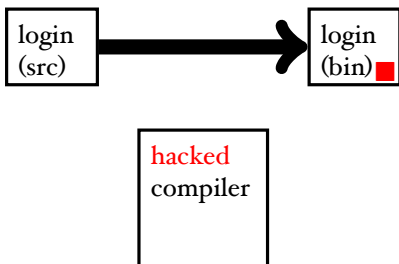
**Using a compiler,  
how can you mount the  
perfect attack against a system?**

# What is a **perfect** attack?

- 1 you can potentially completely take over a target system
- 2 your attack is (nearly) undetectable
- 3 the victim has (almost) no chance to recover

clean  
compiler





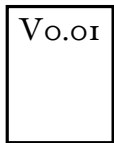
my compiler (src)



Scala

host language

my compiler (src)

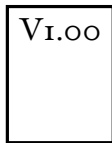


Scala



Scala

...



Scala

host language



my compiler (src)

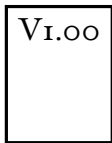


Scala

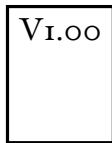


Scala

...

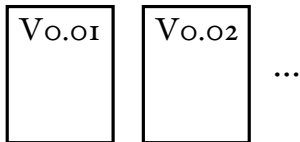


Scala



host language

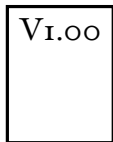
my compiler (src)



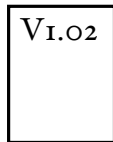
Scala

Scala

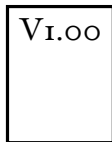
host language



Scala



...



...

no host language  
needed

# Hacking Compilers



Ken Thompson  
Turing Award, 1983

Ken Thompson showed how to hide a Trojan Horse in a compiler **without** leaving any traces in the source code.

No amount of source level verification will protect you from such Thompson-hacks.

Therefore in safety-critical systems it is important to rely on only a very small TCB.

# Hacking Compilers



Ken Thompson  
Turing Award, 1983



- 1) *Assume you ship the compiler as binary and also with sources.*
- 2) *Make the compiler aware when it compiles itself.*
- 3) *Add the Trojan horse.*
- 4) *Compile.*
- 5) *Delete Trojan horse from the sources of the compiler.*
- 6) *Go on holiday for the rest of your life. ;o)*

# Hacking Compilers



Ken Thompson  
Turing Award, 1983

Ken Thompson showed how to hide a Trojan Horse in a compiler **without** leaving any traces in the source code.

No amount of source level verification will protect you from such Thompson-hacks.

Therefore in safety-critical systems it is important to rely on only a very small TCB.