

*We have to **watch and listen to everything that people are doing** so that we can catch terrorists, drug dealers, pedophiles, and organized criminals. Some of this data is sent unencrypted through the Internet, or sent encrypted to a company that passes the data along to us, but we learn much more when we have **comprehensive direct access to hundreds of millions of disks and screens and microphones and cameras.***

This talk explains how we've successfully manipulated the world's software ecosystem to ensure our continuing access to this wealth of data. This talk will not cover our efforts against encryption, and will not cover our hardware back doors.

Making sure
software stays insecure

Daniel J. Bernstein

University of Illinois at Chicago &
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Distract managers

Identify activities that
can't produce security
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Example: virus scanner

Divert attention, focus
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Example: automat
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Known hole in Product 2014.06?

Update now to Product 2014.07!

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Reality: Product 2014.07 also has security holes that attackers are exploiting.

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to your supervisor and/or
law enforcement.”

Finally, you will have
secure computers for work and
personal use.”

Distract programmers

Example: automatic low-latency
software “security” updates.

Marketing: “security” is defined
by *public security holes*.

Known hole in Product 2014.06?
Update now to Product 2014.07!

To help the marketing,
publicize actual attacks that
exploit public security holes.

Reality: Product 2014.07
also has security holes
that attackers are exploiting.

Distract

Example:
When releasing updates,
showing that updates
create a security hole
the amount of time

“You can’t have it all.”

“How many updates?”

“Do you really need
to use 10 updates
just to be secure?”

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⇒ More attack papers!

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Prioritize compatibility,
“standards”, speed, etc. e.g.:

“**An HTTP server in the kernel is critical for performance.**”

researchers

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competition for

amount of damage.

"Corrupted only one file?"

"How many users are affected?"

"How long do you really expect an attacker

to use 100 CPU cores for a month

to break this system?"

"Write attack papers!"

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Page security

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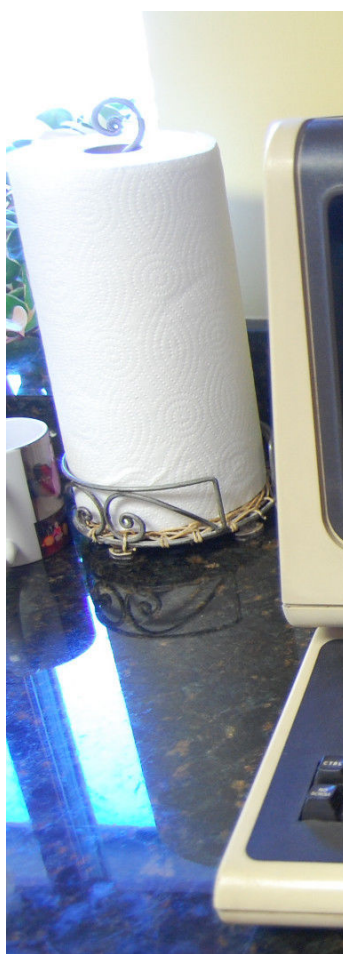
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The trusted comp

1987: My first UN
Low-cost terminals
multi-user Ultrix c



Picture credit:
terminals.classicc.com/wiki/index.php/DE

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The trusted computing base

1987: My first UNIX experience
Low-cost terminals access multi-user Ultrix computer.



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I log in to the Ultrix
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Eve	Eve's files
Frank	Frank's fi

OS kernel allocate

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Eve	Eve's proc
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OS kernel allocates RAM:

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CPU hardware enforces
memory protection

a user process cannot
read or write files
or RAM in other processes
without permission

Kernel enforces various

When a process creates
process or a file, kernel

Process is allowed to
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How is this implemented?

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3. Check all other kernel code.

Bugs anywhere in kernel can override these rules.

Memory protection doesn't apply; language (C) doesn't compensate.

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The code we have to check **trusted computing base.**

Security metric #1: TCB size

Eve can't write Dan's files unless there's a TCB bug.

Eve's actions: irrelevant.

Other software: irrelevant.

Millions of lines of code that we *don't* have to check

Do we need an audit log? No

Keep computers separate? No

Limit software Eve can run?

Assume the hardware works.

How do we verify that

Eve can't write Dan's files?

1. Check the code that enforces these rules.
 2. Check the code that allocates disk space, RAM; and user-authentication code.
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File sharing

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But users are not aware of many of the details.

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So far have described complete user isolation.

But users want to share many of their files. Consider the Web,

I want to be able to mark a file I own as readable to just me or also readable to my group or to Eve+Frank; or to a bigger group; or to the general public.

The code we have to check is the **trusted computing base**.

Security metric #1: TCB size.

Eve can't write Dan's files unless there's a TCB bug.

Eve's actions: irrelevant.

Other software: irrelevant.

Millions of lines of code that we *don't* have to check.

Do we need an audit log? No.

Keep computers separate? No.

Limit software Eve can run? No.

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Obvious implementation:

The OS kernel tracks
source for each file, process.

When my copying process
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the OS kernel marks Frank
as a source for that process.

When process creates file,
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Web browser

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Frank posts news-
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My browser retriev
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