Digital fragilities

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CNRS / Verimag

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A word of warning

I know about

- program verification
- decision procedures, proof systems
- algorithms, decidability, complexity theory
- safety of embedded systems (applications to avionics & nuclear power plants)
- (to some extent) cybersecurity

I do not claim to be

- an expert on IT systems in the large
- a political scientist, an expert on international relations and law
- a historian of technology

Fragility, agentivity, resilience

Fragility vs resilience

- Something slightly wrong happens, things break majorly
- vs we work around the problem

Agency vs powerlessness

Can we do something about it if it breaks?

Plan

Links get cut

Software fragility

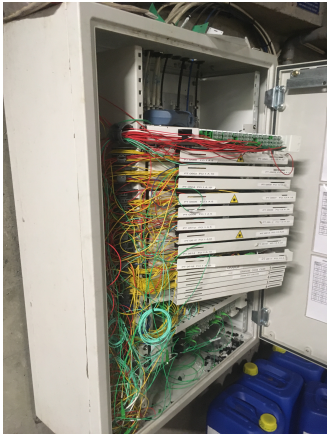
Thin or fat clients?

Political fragility

Backhoe 1 — Optical fiber 0

credit: Digger tom, licence: CC-BY-SA

The spaghetti incident



An anecdote

Networked machines at research lab with

- its own file servers
- its own authentication servers (login / password)
- thus **theoretically** autonomous

rendered unusable when an upstream link was disconnected in another building.

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DNS ?

A question

If something breaks elsewhere (unrelated to us), are we affected?

Condition to work = **logical and** of everything involved works

Complexity

credit: Sebleouf, licence: CC-BY-SA-4.0;

You fuel, you pay in cash

→

credit: Daniel Mietchen, licence: CC0-1.0

- register into an app (and give personal information)
- cell phone must have a network connection
- app talks to servers
- servers talk to pump through network
- pump talks to car
- **charging fails if any of this fails**

AWS out, you can't use your bed

"Owners of Luxury Smart Beds Literally Lost Sleep Due to AWS Outage"

"The AWS Outage Bricked People's $2,700 Smartbeds"

"AWS Outage Proves Smart Beds Are Too Smart: Eight Sleep Users Trapped by Failed Servers"

"At 3 AM on October 20, 2025, thousands of people woke up in puddles of their own sweat. Their crime? Trusting a mattress cover that needed the internet to function."

Too complex electronics?

Even if you purchase electronics, does it have backdoors?

CPU backdoors?
https://i.blackhat.com/us-18/Thu-August-9/us-18-Domas-God-Mode-Unlocked-Hardware-Backdoors-In-x86-CPUs-wp.pdf

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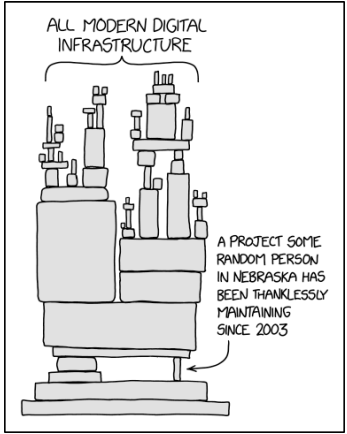
Political fragility

An old problem: proprietary formats

Only software from company X reads files in format Y

- keep buying from company X
- what happens if software gets discontinued
- what happens if company goes under

Dependency



Randall Munroe, XKCD 2347

XZ

XZ maintainer is alone and depressed

Social engineering

Voluntary introduction of a backdoor

https://en.wikipedia.org/wiki/XZ_Utils_backdoor

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Central computer + terminals

credit: Emiliano Russo, licence: Public domain

credit: [Tycho], licence: CC0-1.0

For the general public

credit: Frédéric Bisson, licence: CC-BY-2.0

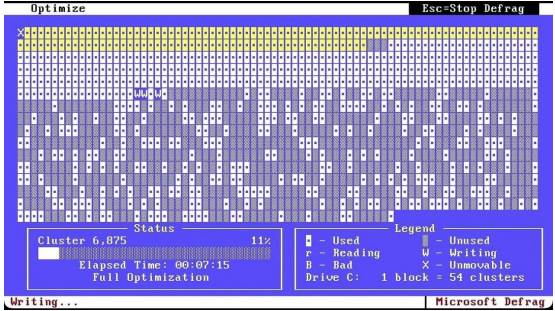
Individual freedom

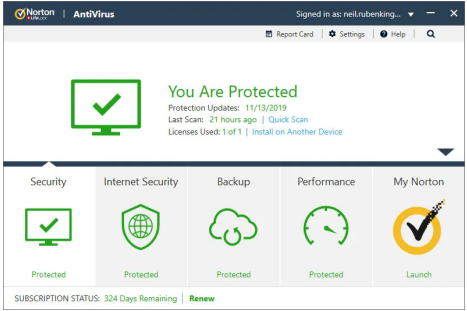
credit: Bill Bertram, licence: CC-BY-SA 2.5

credit: Batocera Teeam, licence: public domain

credit: André Karwath, licence: CC-BY-SA 4.0

Individual problems





A PC is very difficult to administer for a normal person.
Dubious software gets installed, viruses spread...

Centralized app repository

The problem

Individual users can't be trusted to know which programs to trust and their machine will become unusable and full of viruses.

The answer

A centralized organization of trust vets programs

- Linux / BSD distributions repositories
- Apple / Android app stores

Hacking

- Corporate / university / hospital networks get hacked
- Ransomware

Cloud computing

The problem

Running an email server, compute servers, Web servers, desktop machines

- is complicated
- needs expertise, thus employees, and costs money

The answer

A centralized organization (AWS, Azure, Google...)

- stores your data
- provides server services
- provides application

Minitel 2.0

(Benjamin Bayard)

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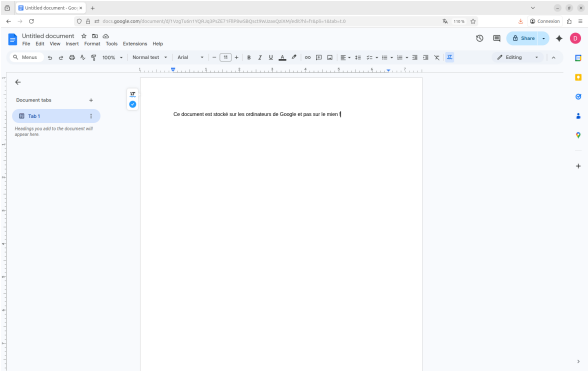

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The cloud is just someone else's computer

Yes I know about

- encrypted storage
- homomorphic encryption
- zero-knowledge proofs...

Still **the Cloud is just someone else's computer**

Ni vu ni connu

It is so easy to grant access.

(anecdote about Wikimedia)

The USA does not like the ICJ

Chief prosecutor

- ICJ uses Microsoft for email
- chief prosecutor Karim Khan was sanctioned by the US
- his email was cut

More generally

All sanctioned individuals (judges or prosecutors) are barred from anything that involves a US company as an intermediary

- paying by Visa or Mastercard or PayPal
- Expedia or other similar sites

Others

- Thierry Breton
- pressures on judges in Marine Le Pen's case
- declarations from US ambassador to France on Quentin Deranque's death

Что де́лать?

What is to be done?

(Anybody will have a good reason not to stop using their favorite app, software, videoconference system...)