CLIP OS: Building a defense-in-depth OS with the Linux kernel and open source software

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Agence nationale de la sécurité des systèmes d'information (ANSSI)

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About the ANSSI

- *Agence nationale de la sécurité des systèmes d'information*
- French authority in the area of cyberdefence, network and information security
- We are **not** an intelligence agency

Overview

CLIP OS?

- Linux distribution developed by the ANSSI
- Initially only available internally
- Now open source, mostly under the LGPL v2.1+
- Code and issue tracker hosted on GitHub[1][2]:
  - Version 4: available as reference and for upstream patch contribution
  - Version 5: currently developed version, alpha status

[1] https://github.com/CLIPOS
[2] https://github.com/CLIPOS-Archive

CLIP OS?

Not yet another Linux distribution

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Targets three main use cases

- Office workstation
- Administration workstation
- IPsec gateway

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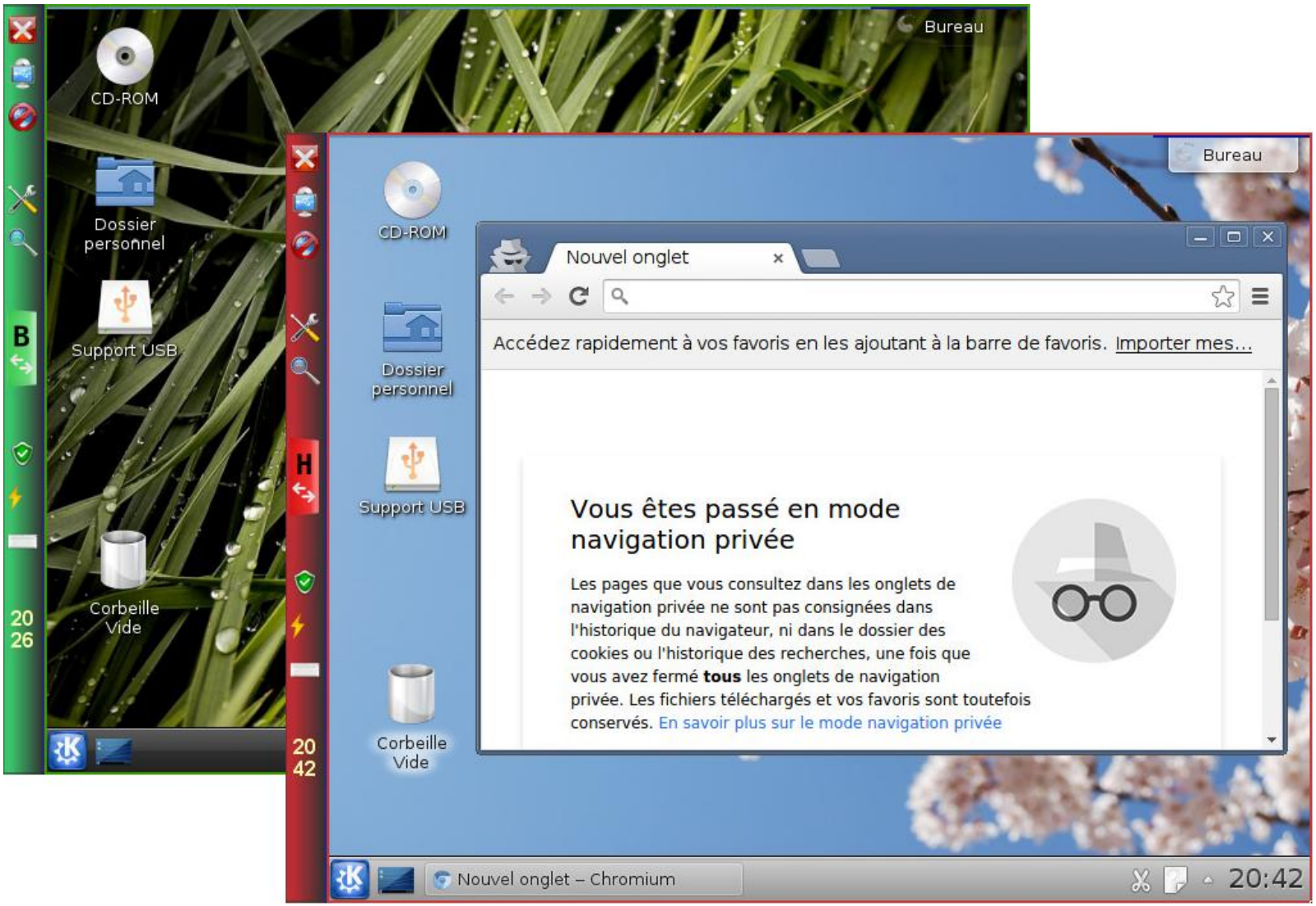
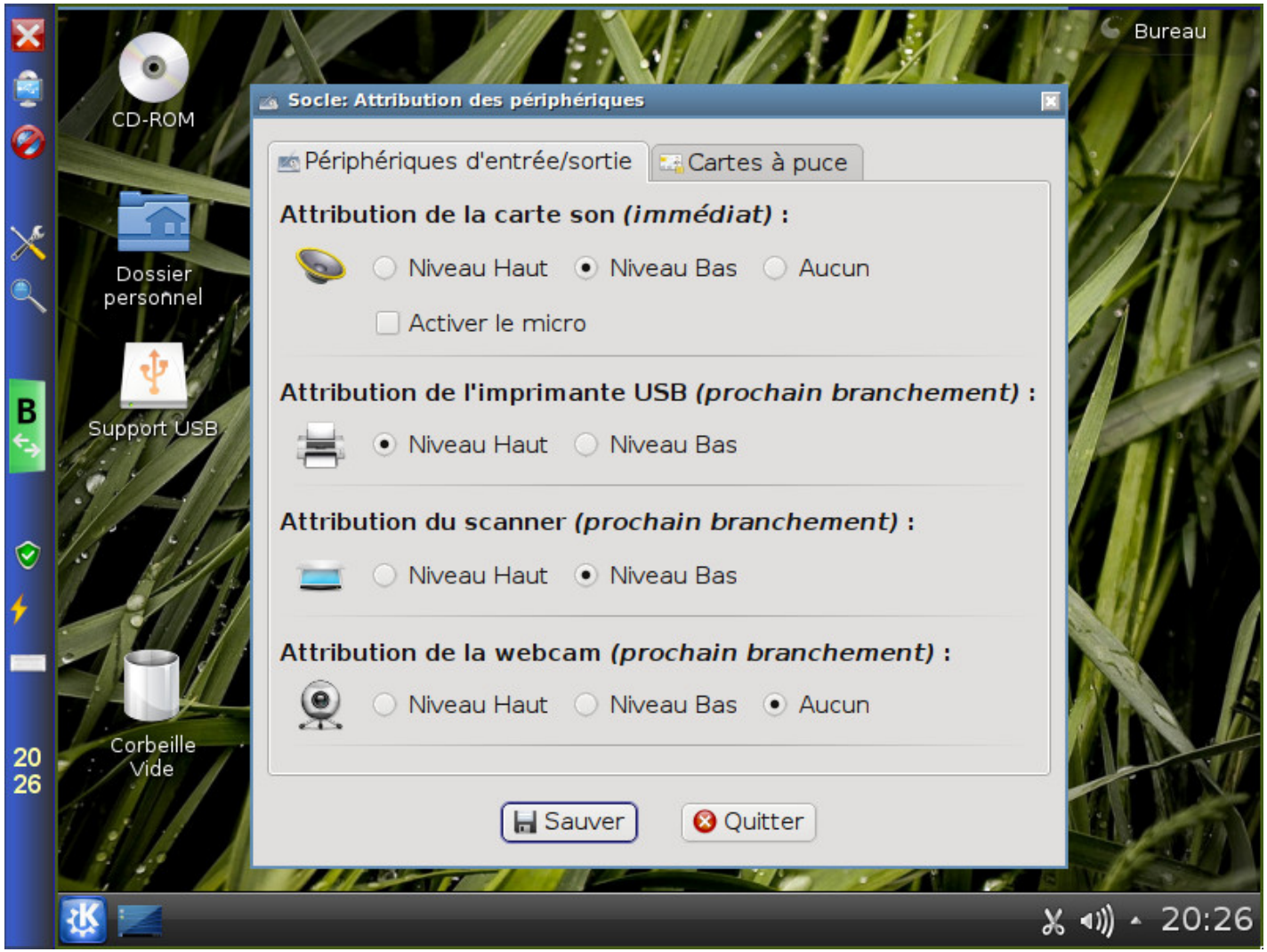
  - Provide two isolated user environments
  - Controlled interactions between isolated environments

Multilevel from the end user point of view



Admin panel: devices assignment per level



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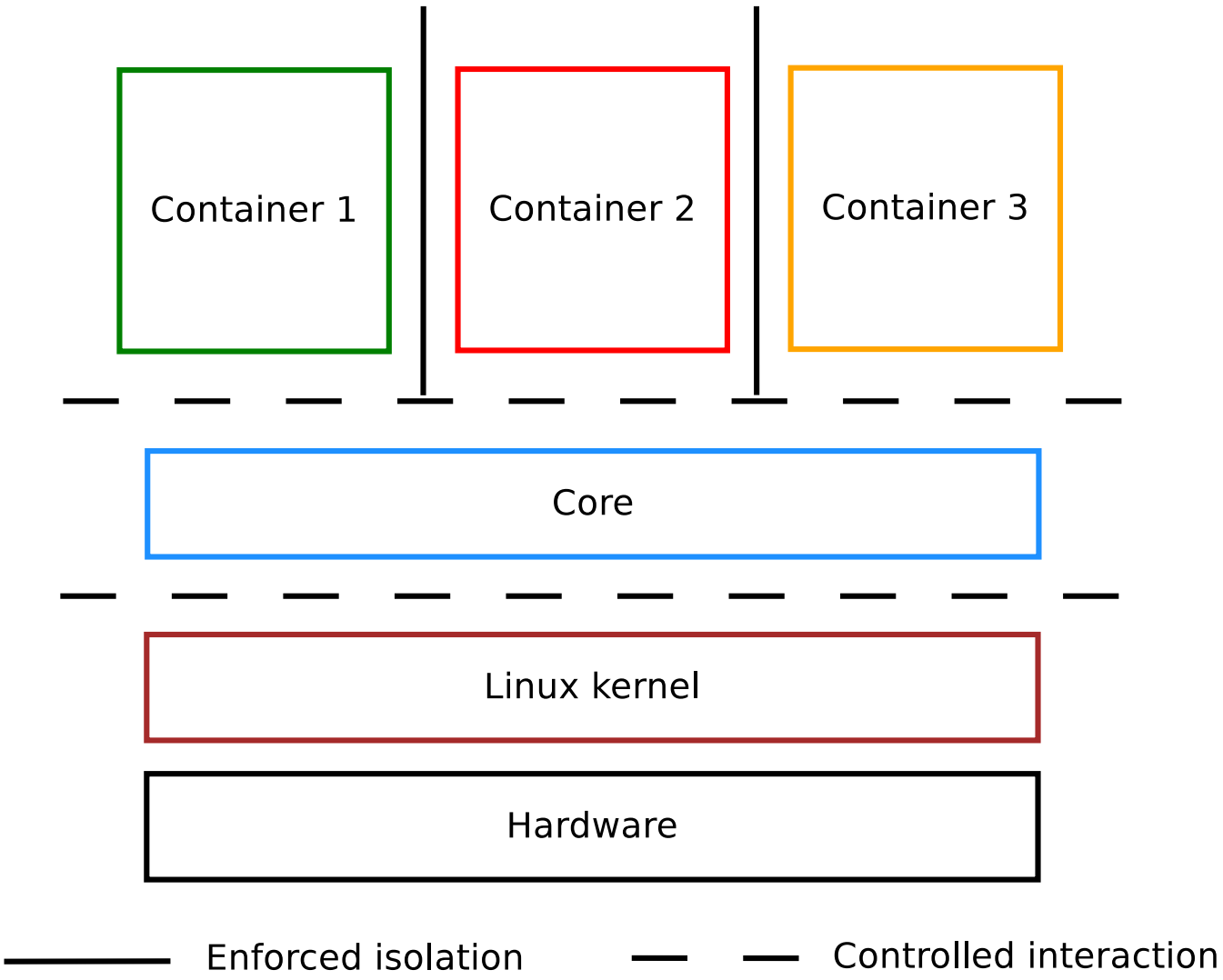
Technical point of view

- Hypervisor (Qubes OS) vs. supervisor isolation (CLIP OS)
- CLIP OS: Limited access rights and capabilities, even for administrators

CLIP OS 5

Architecture



First public alpha release

- Functional core (boot to command line shell)

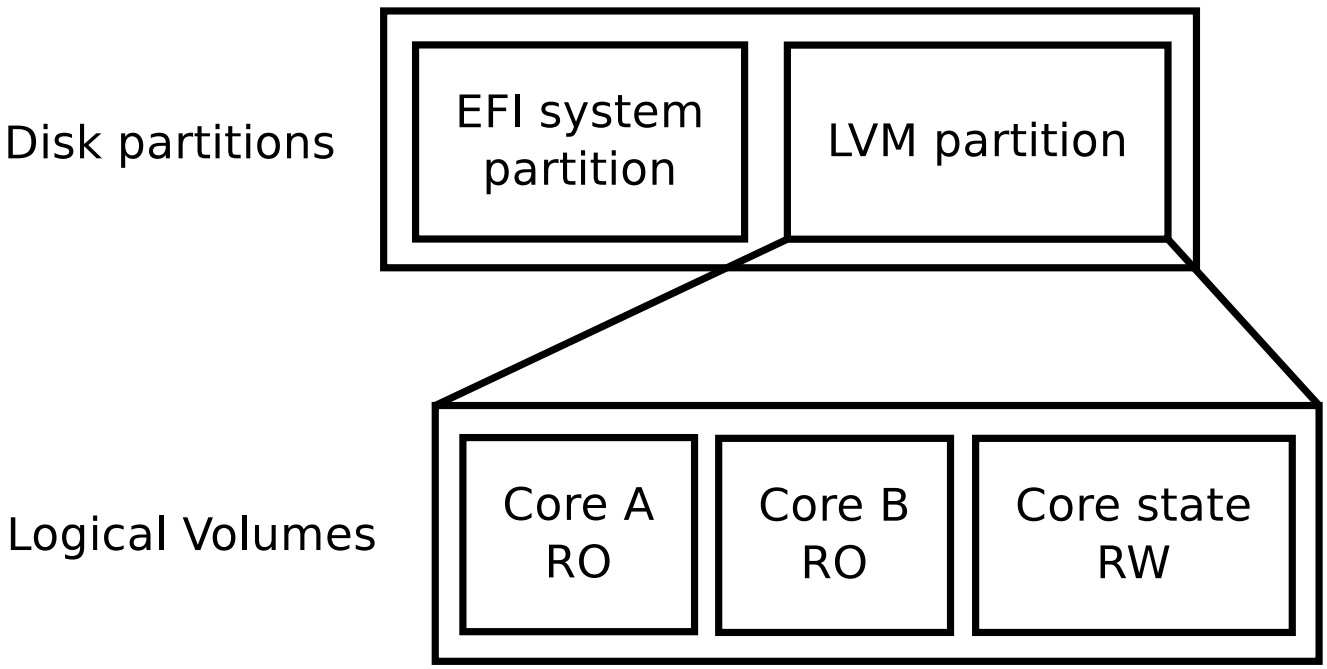
```
This is clipos-qemu.unknown_domain (Linux x86_64 4.18.18-r1-clipos) 13:45:15

Hint: Num Lock on

clipos-qemu login: root
Last login: Thu Nov 29 13:43:03 UTC 2018 on tty1
clipos-qemu / # lsblk
NAME                          MAJ:MIN RM   SIZE RO TYPE  MOUNTPOINT
vda                           254:0    0    20G  0 disk
|-vda1                        254:1    0   512M  0 part  /mnt/efiboot
`-vda2                        254:2    0  19.5G  0 part
  |-mainvg-core_5.0.0--alpha.1  252:0    0     4G  0 lvm
  | `-verity_core_5.0.0-alpha.1 252:3    0 158.5M  1 crypt /
  |-mainvg-core_state           252:1    0   512M  0 lvm
  | `-core_state_dif            252:4    0   474M  0 crypt
  |   `-core_state              252:5    0   474M  0 crypt /mnt/state
  `-mainvg-core_swap            252:2    0     1G  0 lvm
    `-swap                      252:6    0     1G  0 crypt [SWAP]
clipos-qemu / # uname -sr
Linux 4.18.18-r1-clipos
clipos-qemu / #
```

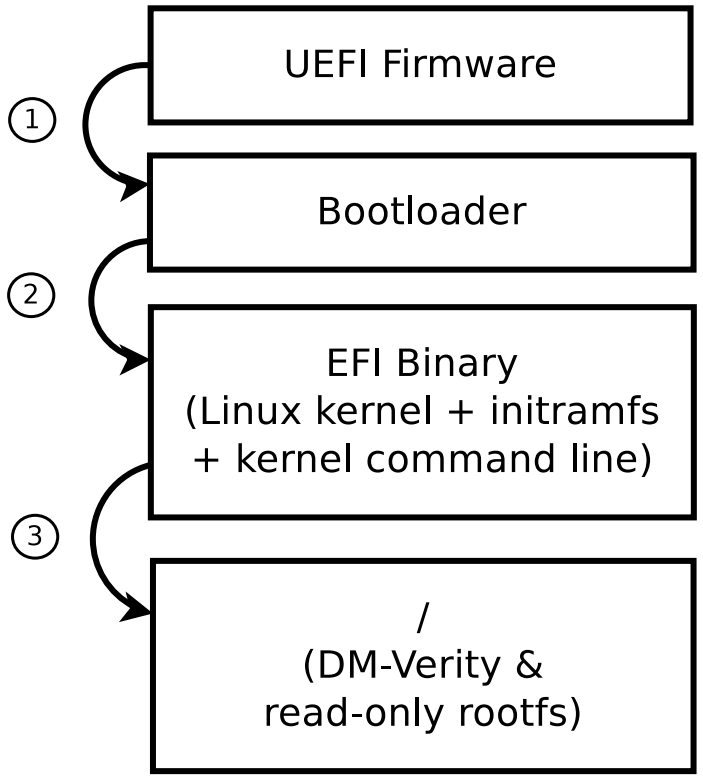
First public alpha release

- Strict split between:
  - Read Only: system executables, configuration and data
  - Read Write: runtime configuration, logs, user and application data



First public alpha release

- Initial boot chain integrity:
  - Secure Boot (bootloader, initramfs, Linux kernel and its command line)
  - Read-only system partition protected by DM-Verity



First public alpha release

- Initial hardware support: QEMU/KVM virtual machine

Features added or in progress since alpha

Added:

- Read-write system data stored in a DM-Crypt+Integrity volume
- Initial hardware profiles support

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In progress:

- TPM support for unattended LUKS secret unsealing (system RW data)
- Public infrastructure setup:
  - Code review (Gerrit)
  - Buildbot (daily and on-demand builds)

Roadmap: Beta

- Client for automatic updates
- Confined IPsec client and SSH server
- Basic network (DHCP, static IP) and firewall (static rules) support
- "Unprivileged" admin, audit and update roles
- Initial physical hardware support

Roadmap: 5.0 stable

- Confined user environments (GUI)
- Multilevel support (Vserver-like LSM)
- Automated installation using PXE
- etc.

Working on CLIP OS?

See full documentation at `https://docs.clip-os.org`:

- Install dependencies
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- Incremental: about 5-10 minutes (and more depending on compilations)

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Join us at the Workshop this afternoon at 15h, room Projection, 2nd floor

Conclusion

Open source project:

- Sources: https://github.com/CLIPOS
- Bugs: https://github.com/CLIPOS/bugs
- Contribute with GitHub pull-requests

Code review (Gerrit) and Buildbot infrastructure setup in progress.

Planned contributions:

- Linux kernel (https://github.com/clipos/src_external_linux)
- CLIP OS version 4 patches will be submitted upstream
- Gentoo ebuilds, etc.

Thanks!

✉ clipos@ssi.gouv.fr

- Website: clip-os.org
- Docs: docs.clip-os.org
- Sources: github.com/CLIPOS
- Bugs: github.com/CLIPOS/bugs

We're hiring! (but not directly for CLIP OS)

Linux system security expert

https://www.ssi.gouv.fr/emploi/expert-en-securite-des-systemes-linux/