Infrastructure as Commons, Low-Tech Principles and Territorial Distribution: a magical recipe for resilience?

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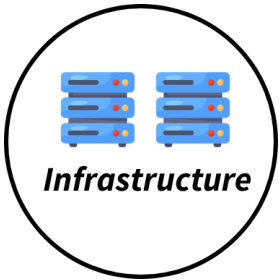
What is the magic soup about?

Who is the apprentice wizard ?

In September 2025 I started a PhD thesis in Computer Sciences with Hélène Coullon, Baptiste Jonglez, Erwan Bousse and Théo Le Calvar on **“Resilience of digital services infrastructure managed as commons”**. It is in partnership with the Deuxfleurs association that I joined earlier this year.

We do not have results as of today because the work is in its infancy, hence this presentation goal is to show possibilities of new resilient approaches rather than results backed by our own scientific data.

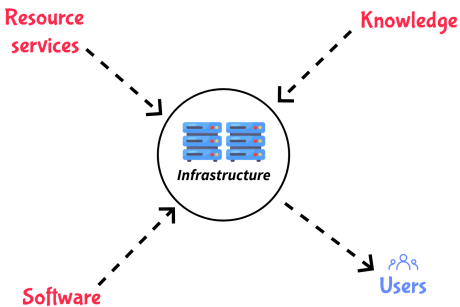
Infrastructure and fluctuating dependencies



Our ICT infrastructure comprises :

- the hardware (e.g. CPU, GPU, Disks)
- the software (e.g. OS, Services)

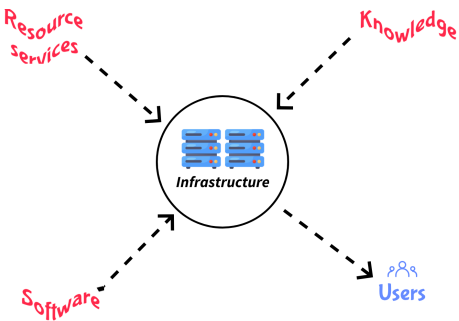
Infrastructure and fluctuating dependencies



Infrastructure have external dependencies.

It would not be a problem if we lived in a limitless-resources world where everybody is being nice.

Infrastructure and fluctuating dependencies



Sadly we do not live in such a world.

These last years we have seen an increasing rate in crisis that make the external dependencies fluctuate.

In order to continue providing services in the future we need to work on resilience.

Resilience

Robustness

"the degree to which a system or component can function correctly in the presence of invalid inputs or stressful environmental conditions"

Survivability

"pertaining to a system or component that continues to provide partial operational capability in the event of certain failures"

Adaptability

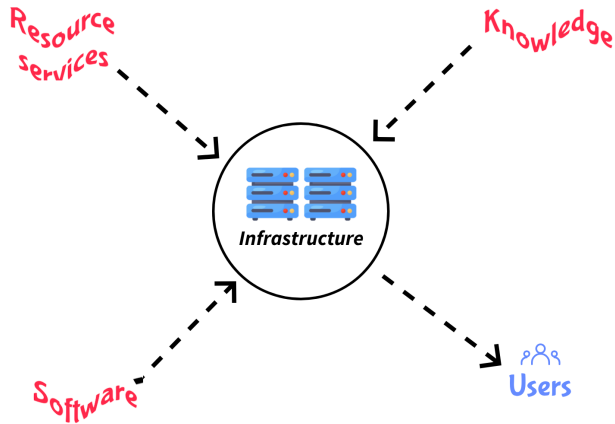
"The ease with which a system or component can be modified for use in applications or environments other than those for which it was specifically designed"

Resilience

Today's infrastructure management is very much centered around performance and cost efficiency which is not compatible with tomorrow fluctuating world.

Proposed magical ingredients for resilience

Infrastructure as Commons



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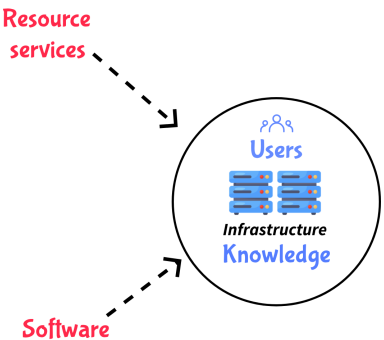

Users being integrated in the management of the infrastructure, their voice could be heard and it would make the decisions in times of crisis shift from cost-centric to community-centric.

Having no external knowledge would also create a better adaptivity in times of crisis because the people managing the infrastructure would have all the tools needed to make it evolve and adapt to new conditions.

Infrastructure as Commons

But wait ! It exists ! It's called Commons[1],[2]!

Historically commons have been studied through primary resources (e.g. forests, water). And essentially they are :

- A common pool resource
- A community with boundaries
- A set of rules

They possess outstanding time persistence, so they can be an inspiration for infrastructure management.

[1] E. Ostrom - *"Governing the commons: the evolution of institutions for collective action"*

[2] E. Jourdain - *"Les communs"*

Infrastructure as Commons

Here is how we are envisioning it :

- **A common pool resource;** both the *hardware* and the *software*
- **A community with boundaries;** the users, the maintainers (devops) and the developers
- **A set of rules;** a charter, decision mechanisms for the community

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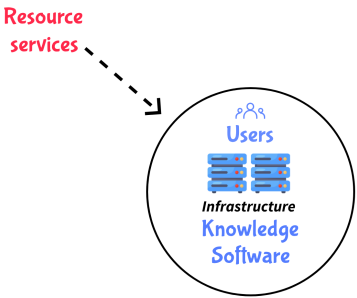
Low-Tech principles



If software was developped by the mainteners of the infrastructure, they would be tailored to the need of the services. Consuming less, being easier to maintain, easier to adapt.

Low-Tech principles

But wait ! It exists ! It's called low-tech !

A computer even in it's simplest form is far from being low-tech, though some principles could be applied to infrastructure management and software development.

[1] ADEME. Démarches "low tech", 2022. https://librairie.ademe.fr/consommer-autrement/5421-demarches-low-tech.html

[2] Low-Tech Lab. What are low-techs?, 2025. https://lowtechlab.org/en/low-techs

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Simplicity
E.g. A complex software with exhaustive and intuitive documentation

Locality
Software being developped localy

Low environmental footprint
E.g. Environmental constrained softwares

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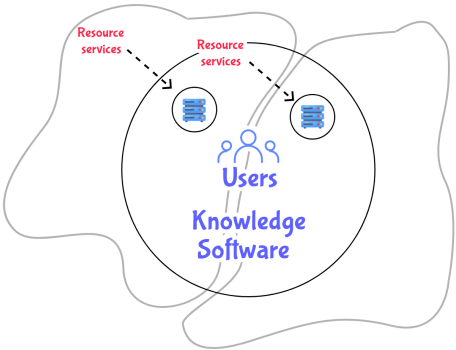
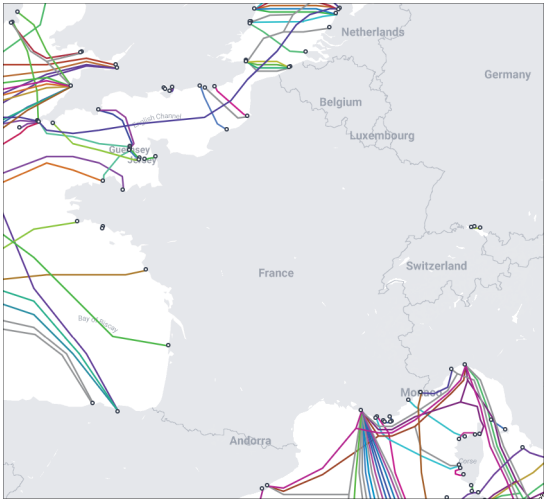
Territorial Distribution



Fault tolerance can hardly go without redundancy and distribution. The goal is to survive external dependency fluctuations. It would be interesting if the external dependencies where not linked together, so as if one fluctuate the others continue working.

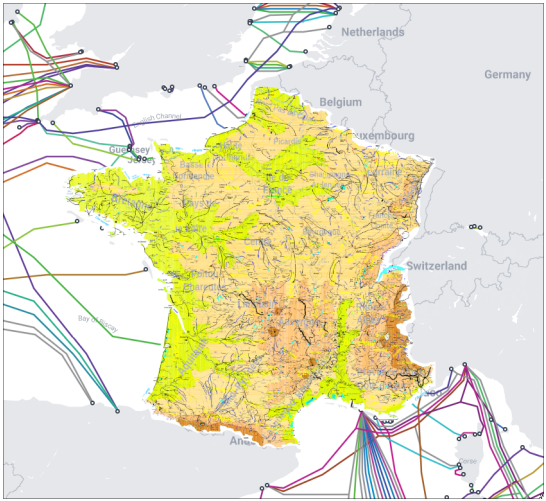
Territorial Distribution



Let's layer maps of :

- Submarine internet cables

Territorial Distribution



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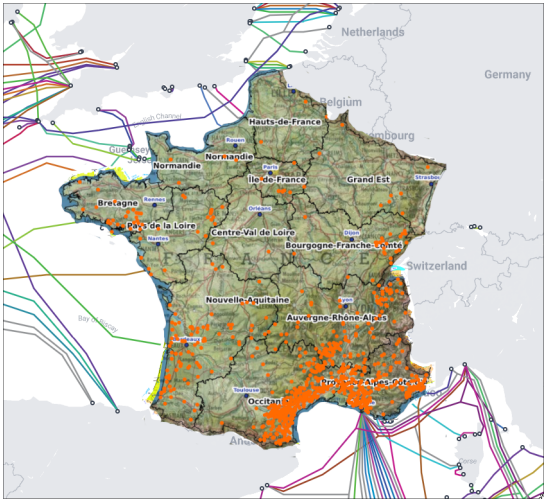

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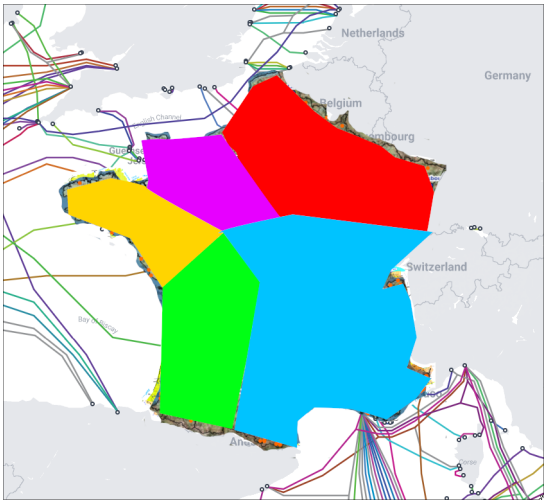

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We have roughly 5 zones where we can setup our infrastructure.

(the zones are not scientifically acurate)

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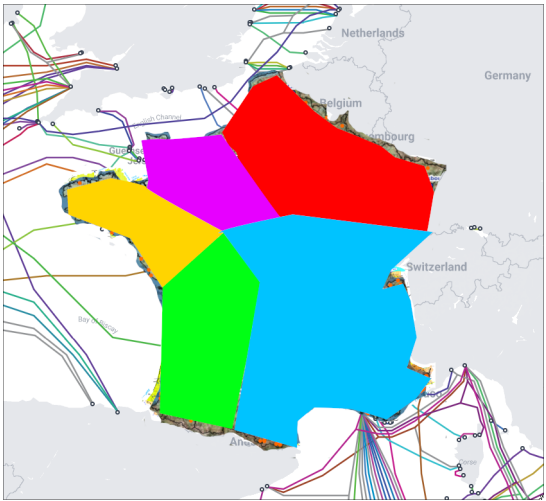

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Downsides of our recipe

Having a low resource footprint while duplicating our infrastructure ?

Is it usable outside of infrastructure on the smaller scale ?

https://www.deviantart.com/emthebatty/

Conclusion

The state of our research

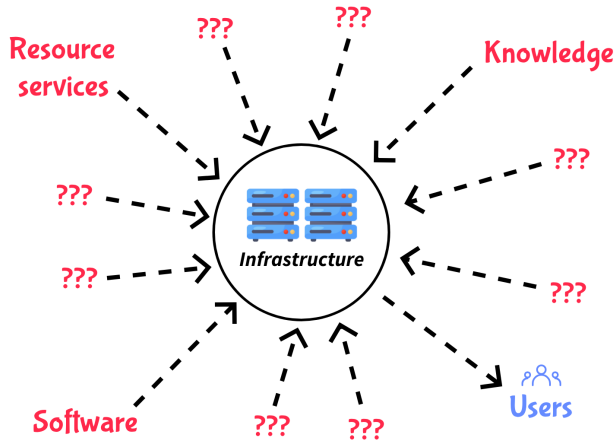
We are working toward creating a resiliency assessment framework and a model of infrastructure managed as commons to apply said framework.

Hélène Coullon is creating a new INRIA team around resilience.

But these are our own ingredients !

Next steps

There exists a multitude of external dependencies and fluctuations depending on the use case. Interdisciplinary research is crucial.



Next steps

What would your magical recipe be ?

As in how would you make infrastructure resilient to fluctuating dependencies

Thanks for listening !