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FRANCE 2030
PROGRAMME DE RECHERCHE
NUMÉRIQUE POUR L'EXASCALE

NUMPEX- Ecosystème logiciel – Fev 2026

Challenge

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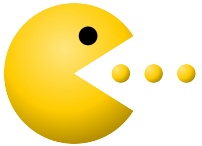
Context:

Post-Exascale apps are becoming increasingly **difficult to build, deploy and maintain** under the double pressure of the **growing machine complexity** and the applications' needs to combine **multiple compute and data processing paradigms (HPC+HPDA+AI).**

At Stake:

Need for **HPC DevOps (HPCOps) methodologies and tools** to enhance **productivity** and enforce **interoperability**, **portability** as well as **reproducibility** (and **sovereignty**?)

Pac-Man



Empowering users beyond modules with modern **Package Managers (Guix, Spack)**

→ Modern Package managers: package repos, CI, binary caches, shared build nodes, advanced CLI…..

> guix install mysoft

Native instals:

- Slices-fr/Grid'5000: Guix and Spack
- Mésocentre GRICAD: Guix & Nix (and no module)
- CINES (Adastra): Guix available March 26.

Infrastructure dependencies

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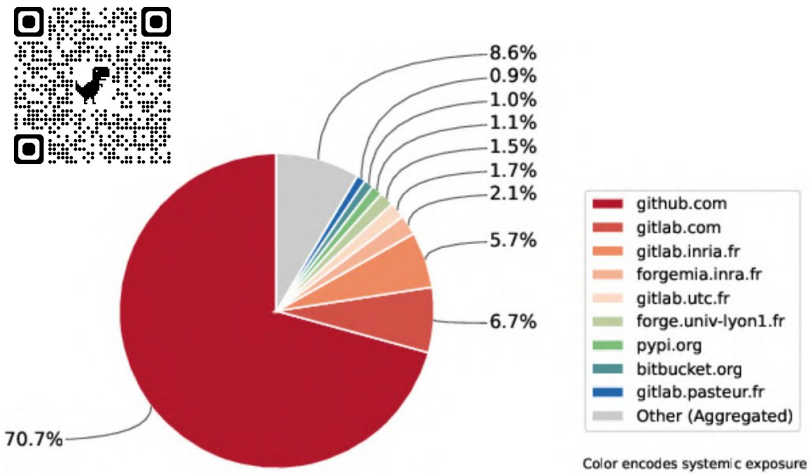
Global Concentration = Global Risk



Collaborative development depends massively
on *very few* ~~*single*~~ *points of failures*

Projects with contributions from French Academia
(courtesy of Software Heritage, 2026)

Git repos: institutional repos or github ?

Guix-Science (github)
Guix-HPC (gitlab.inria.fr)

2025

Codeberg
1076 packages today

What about the 10000s other components?

CI/CD/CB: necessary but where ? Cost ?

EuroHPC: some machines, user's account/budget
Slices-fr/Grid'5000: some users, not the mission?
Other (need a variety of hardware) ?

Supporting Infrastructures

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Guix ....

Software Heritage
THE GREAT LIBRARY OF SOURCE CODE

Source Code Archiving to the Rescue of Reproducible Deployment

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ABSTRACT

The ability to *verify* research results and to *experiment* with methodologies are core tenets of science. As research results are increasingly the outcome of computational processes, software plays a central role. GNU Guix is a software deployment tool that supports *reproducible* software deployment, making it a foundation for computational research workflows. To achieve reproducibility, we must first ensure the source code of software packages Guix deploys remains available.

We describe our work connecting Guix with Software Heritage, the universal source code archive, making Guix the first free software distribution and tool backed by a stable archive. Our contribution is twofold: we explain the rationale and present the design and implementation we came up with; second, we report on the archival coverage for package source code with data collected over five years and discuss remaining challenges.

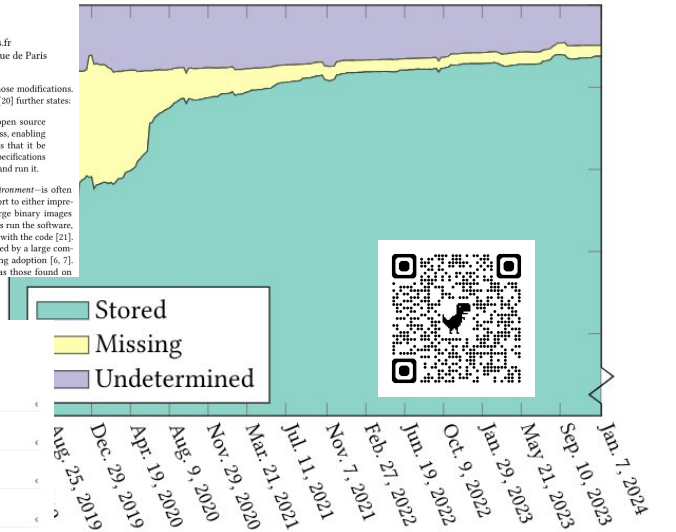
use it, to study it, to modify it, and to share those modifications. UNESCO's Recommendation on Open Science [20] further states:

> In the context of open science, when open source code is a component of a research process, enabling reuse and replication generally requires that it be accompanied with open data and open specifications of the environment required to compile and run it.

That last part—the *specifications of the environment*—is often overlooked or dismissed: researchers often resort to either imprecise natural-language build instructions or large binary images ("containers" or virtual machines) that let others run the software, but typically prevent them from experimenting with the code [21].

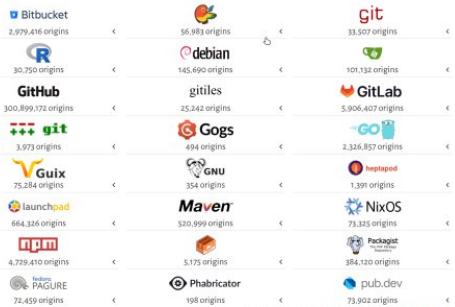
Guix is a software deployment tool developed by a large community since 2012 and which is seeing growing adoption [6, 7]. It can be used as a "package manager" such as those found on

ACM REP '24, June 18–20, 2024, Rennes, France



Relative SWH archive coverage by sampled Guix (truncated at 50%).

The largest archive ever built



figures as of January 9 2026

Supporting Entities

Funding ? Sustainability ? International visibility ?

National/EU Fundings ? Public Institutions ? Private Companies ? Foundations ?

Examples:

- High Performance Software Foundation (HPFS)
- Guix Foundation
- Software Heritage
- Consortium (scikit-learn, MUMPS)

AI

Software stack: Pytorch, Jax, Ray, Nccl, Glow

Will integrate (replace ?) HPC software

MLOp tools: everything Python, pip, conda, Tensorboard, Neptune.ai...

LLMs coding assistants