THE LINUX FOUNDATION
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PyTorch

Collaborative Infrastructure at Scale: PyTorch's Multi-Cloud CI Model

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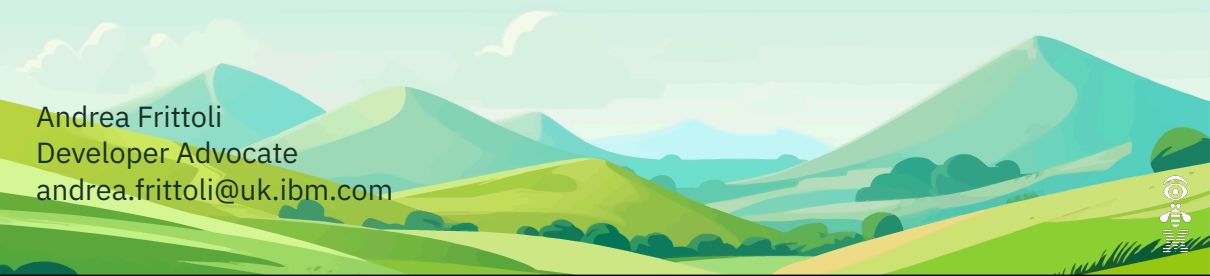

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Contents

The Infrastructure Challenge

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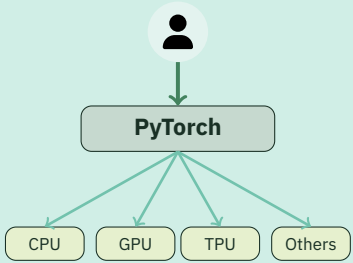
What is PyTorch?

A Leading Open Source ML Framework:

- Researchers, data scientists, ML engineers
- Research and production ML workloads
- (Distributed) Training, LLM, RL, Inference
- Python API, C++ Core (libtorch)
- Eager and Graph Mode (Inductor)
- Rapid growth and adoption across industry



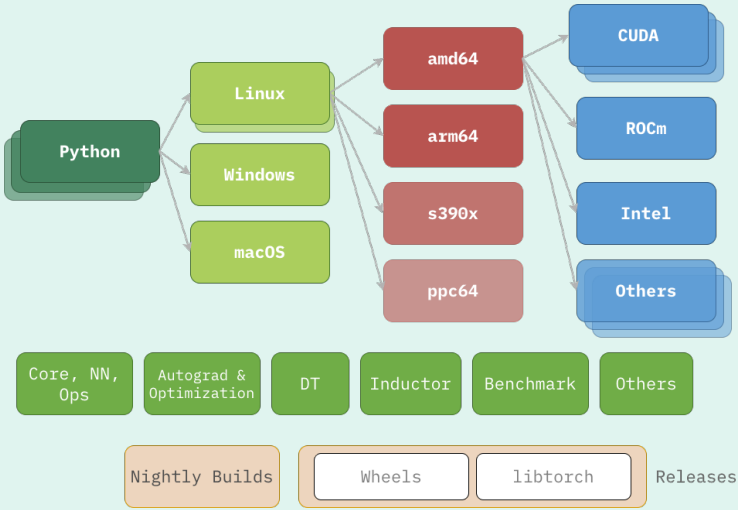
CI/CD Infrastructure Today

- ~1M$ monthly infrastructure costs
- ~1.3k Compute-intensive Workflows/day

- ~1M hours of compute per month
- Growing year over year

`pytorch/pytorch` repo only, numbers are estimated

An Expanding Test Matrix



The Challenges

Scale Challenges:

- **Engineering:** Managing a Diverse Fleet, Access to Platforms
- **Financial:** Reconcile Community Wishes with Budget Constraints

Security Challenges:

- Infrastructure from public clouds and private pool
- Central Administration
- Trusted Builds

Experience Challenges:

- Maintain high-quality end-user experience
- Preserve contributor workflow
- Provide clear path for vendor engagement

PyTorch Foundation & Working Groups

The PyTorch Foundation

Organizational Structure:

- Part of the Linux Foundation
- Neutral home for PyTorch project
- Hosts multiple related projects
- Provides governance framework
- Enables vendor collaboration

Working Groups Addressing the Challenges

Three Key Working Groups:

- **Multi-Cloud CI WG:** Infrastructure sustainability & scale
- **Accelerator Integration WG:** Platform integration & engineering
- **Security WG:** Security standards & practices

Collaborative Approach: Vendors + maintainers working together

Vendor Contribution Models

Three Ways to Contribute:

- **Compute Resources:** Multiple integration levels
- **Engineering Effort:** Integration, maintenance, support
- **Cloud Credits:** Financial contribution for shared infrastructure

Flexible & Proportional:

- Vendors choose contribution model that fits them
- Contribution proportional to their investment/stake

Technical Architecture

Photo by Nadi Whatisdelirium, CC0

Cloud-Agnostic CI Design

Key Principles:

- No vendor lock-in
- Standardized runner interfaces
- Portable CI definitions
- Multi-cloud orchestration

Security & Isolation

Security Considerations:

- Vendor-managed runners in isolated environments
- No access to project secrets
- Network isolation and egress controls
- Audit logging for all runner activity
- Regular security reviews

Monitoring & Observability

Visibility Across Vendors:

- Centralized metrics collection
- Performance monitoring per vendor
- Cost tracking and attribution
- SLA monitoring and alerting
- Public dashboards for transparency

Vendor-Managed Runners

Operational Model:

- Vendors provision and maintain runners
- Standard configuration templates
- Automated scaling based on demand
- Health checks and auto-remediation
- Vendor-specific optimizations allowed

Governance Model

Photo by Thom Milkovic, CC0

Governance Principles

Balancing Act:

- Project autonomy preserved
- Vendor participation encouraged
- Community control maintained
- Transparent decision-making
- Fair representation

Working Group Structure

Organization:

- Regular meetings (bi-weekly/monthly)
- Vendor representatives + maintainers
- Technical subcommittees
- Clear escalation paths
- Public meeting notes

Vendor Onboarding

Standardized Process:

- Technical requirements review
- Security assessment
- Pilot phase with limited workloads
- Performance validation
- Full integration after approval

Handling Conflicts

When Interests Diverge:

- Clear decision-making authority
- Project maintainers have final say
- Vendor concerns heard but not binding
- Documented rationale for decisions
- Exit strategy for vendors

Results & Lessons Learned

Platform Coverage Expansion

Achievements:

- X% increase in platform coverage
- New accelerator support (specific examples)
- Reduced time-to-market for new platforms
- Improved test reliability

Financial Impact

Sustainability Achieved:

- Distributed infrastructure costs
- Reduced burden on primary sponsor
- Predictable scaling model
- Long-term financial sustainability

Vendor Onboarding Experience

Feedback from Vendors:

- Clear expectations and requirements
- Reasonable onboarding timeline
- Good technical support from maintainers
- Fair governance model
- Challenges: [specific examples]

Key Lessons Learned

What Worked:

- Clear governance from day one
- Security-first approach
- Flexible contribution models
- Transparent communication

What Was Hard:

- Balancing vendor needs with project needs
- Standardization across diverse platforms

Applicability to Other LF Projects

Shared Challenges:

- Accepting vendor infrastructure
- Maintaining project neutrality
- Ensuring transparency
- Achieving financial sustainability

This Model Can Help:

- Proven governance framework
- Technical architecture patterns
- Onboarding playbook

Future Directions

What's Next:

- Expand to more vendors
- Improve automation and tooling
- Share model with other projects
- Refine governance based on experience
- Build community of practice

Key Takeaways

- Infrastructure costs can be distributed sustainably
- Vendor contributions work with right governance
- Project autonomy and vendor participation can coexist
- Security and transparency are non-negotiable
- Model is applicable to other LF projects

Questions?

Brecon Beacons, Wales, Photo by Carl Jorgensen, CC0

References & Contact

Resources:

- PyTorch Multi-Cloud CI Working Group: [URL]
- Documentation: [URL]
- GitHub: [URL]

Contact:

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