Susereum: Towards a Reward Structure for Sustainable Scientific Research Software

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Background

• Research has become inescapably Software-Dependent

• Developers of Research Software are
  – Untrained in Software Engineering
  – Transient Workforce
  – Adopt Discovery Driven Methodologies
  – Develop in absence of Requirements

• Research Projects are
  – Driven by scientific contribution
  – Have short funding cycles
Academic Eco-Systems

• Academic careers
  – Advanced by contributions of academic articles
  – Research software are not adequately recognized
• Little incentives to contribute high-quality research codes
• Academic eco system are dependent on peer reviews
  – Effective for static relatively short artifacts (papers)
  – Ineffective for large dynamic text (codes)
Sustainability Fundamental Challenge

• Software Sustainability is not unique to research software
• Professional spheres systematically undermine sustainability
• Prevalent practices
  – Reward engineers for feature development
  – Sustainability is uncertain and invisible
  – Systematic pressures to short-term goals
Price tag for fixing Phoenix pay system now tops original cost

Repair bill has risen to about $402M — more than $309.5M payroll implementation cost in the 1st place

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Causes [ edit ]

There have been several causes put forward for Phoenix's problems, including a new Miramichi pay centre. Federal unions have blamed IBM, the contractor, and eventual $1.2 billion. The former Conservative government...

Dev Cost: $309.5 million
Cost to fix (in Year 1 only): $402 million
How to Address Sustainability

- Training and Education for Researchers and Scientists
- Policies and research funding structures
  - Hiring professional software engineers
- Understand the unique context and quality characteristics of research software.
The goal of this research is to transform the prevalent incentive structures in academia.

We aim to establish an ecosystem that systematically promotes contributions of scientific software. Software that is:

- Sustainable over time to maximize returns
- Disseminatable to other researchers for results extension
- Reproducible for research results extension.
- Attain broader longer-term impacts
Susereum

• Susereum = Sustainability + Ether.
• Distributed Ledger
• Reward contributors of research codes with **immutable**, permanent, peer-recognized credit.
Susereum

**Step One**
Code Change
Event
Susereum

Step Two
Transaction Formation
Susereum

Step Three
Block Formation
Susereum

Step Four
Chain Formation
Susereum

**Step Five**
Chain Propagation to Peers
Susereum

Step Six
Peers Verify
Work
Consensus Protocol

- Proposal Period
- Prioritization
- Voting Period
- Integration & Validation
- Voting Period

Consensus Building

- Proof of Statke
- Proof of Work

- God Class > 400
  Severity = High

- Cont. 1
- Cont. 2
- Cont. 3
- Cont. 4
- Cont. 2
Potential Impact

• Open Source and Professional Spheres
• Scientific and Research Software
• Discovering and Sharing of Novel Sustainability Measures
• Decentralized Sovereignty and Impacts Beyond Software Sustainability
  – Redefine development process, artifacts formalisms, conflict resolutions for artifacts, ..
  – Project task priorities, schedule, task assignments, effort estimates,..
  – Rewards for crowd-based software engineering
Open Questions

• To what extent do “Incentives” affect codebase quality and sustainability?
• How to measure the scientific value of code contributions?
• How to quantify codebase sustainability?

• Analyzing large-scale research codebases
  – QGIS case Study
  – Interviewing Developers
  – Uncover decision making processes for individuals and teams
Summary

- Restructure Incentives with Crypto Credit
- Significant Potential Impact on Software Sustainability
- Decentralization of Sovereignty