Toward a Simulation Model of Open Source Software

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Overview

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- The Chaos that is Open Source
- The NK Model and the edge of chaos
- OSSim
- Some interesting results
- Moving on

Open Source...Chaotic? Never!

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- Anyone can create a project
- Anyone can use a project
- Anyone can contribute to a project
- Anyone can fork a project
- Anyone can distribute a project
- Diverging user requirements
- No formal training for new community members
- Usually lack specification and design documents

Now With 100% Less Sarcasm

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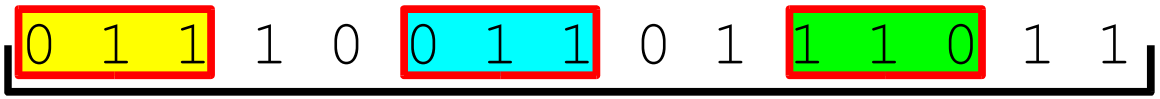
- Not everyone has the skill/knowledge to create projects
- Many projects are so poorly documented that they're nearly impossible to use
- Often times patches are ignored or rejected
- Forking a project takes time and is frequently frowned upon
- Bandwidth costs money
- Birds of a feather flock together
- Communities have indoctrination processes
- The process still makes software engineers cry

NK Model

Agents have a genotype bit string of length N



N=15

Each bit is associated with K neighbors to create alleles

011	011	110
111	110	101
110	101	011
100	011	110
001	111	101

K=2

Each allele has is evaluated against the randomly generated fitness landscape for that position. Overall fitness is the average of these values.

$$\frac{0.15 + 0.19 + 0.20 + 0.46 + 0.34 + 0.85 + 0.67 + 0.12 + 0.77 + 0.91 + 0.85 + 0.55 + 0.72 + 0.06 + 0.59}{15}$$

Mutation in the NK Model

Selects a bit at random, flip it, and evaluate new fitness

0 1 1 1 **1** 0 1 1 0 1 1 1 0 1 1

011	011	110
111	110	101
111	101	011
110	011	110
101	111	101

K=2

$$\frac{0.15 + 0.19 + \mathbf{0.82 + 0.31 + 0.74} + 0.85 + 0.67 + 0.12 + 0.77 + 0.91 + 0.85 + 0.55 + 0.72 + 0.06 + 0.59}{15}$$

0.5493

OSSim

- **Pronounced AWESOME!!**
  - **Make sure to say the exclamation points**
- **Multi-agent simulation**
- **Two classes of agents**
  - **People**
  - **Projects**
- **People agents have a genotype string**
  - **Represents desired feature set**
- **People may have ability to modify projects**
  - **Like real people, skill varies**
- **Project agents have a fitness landscape**

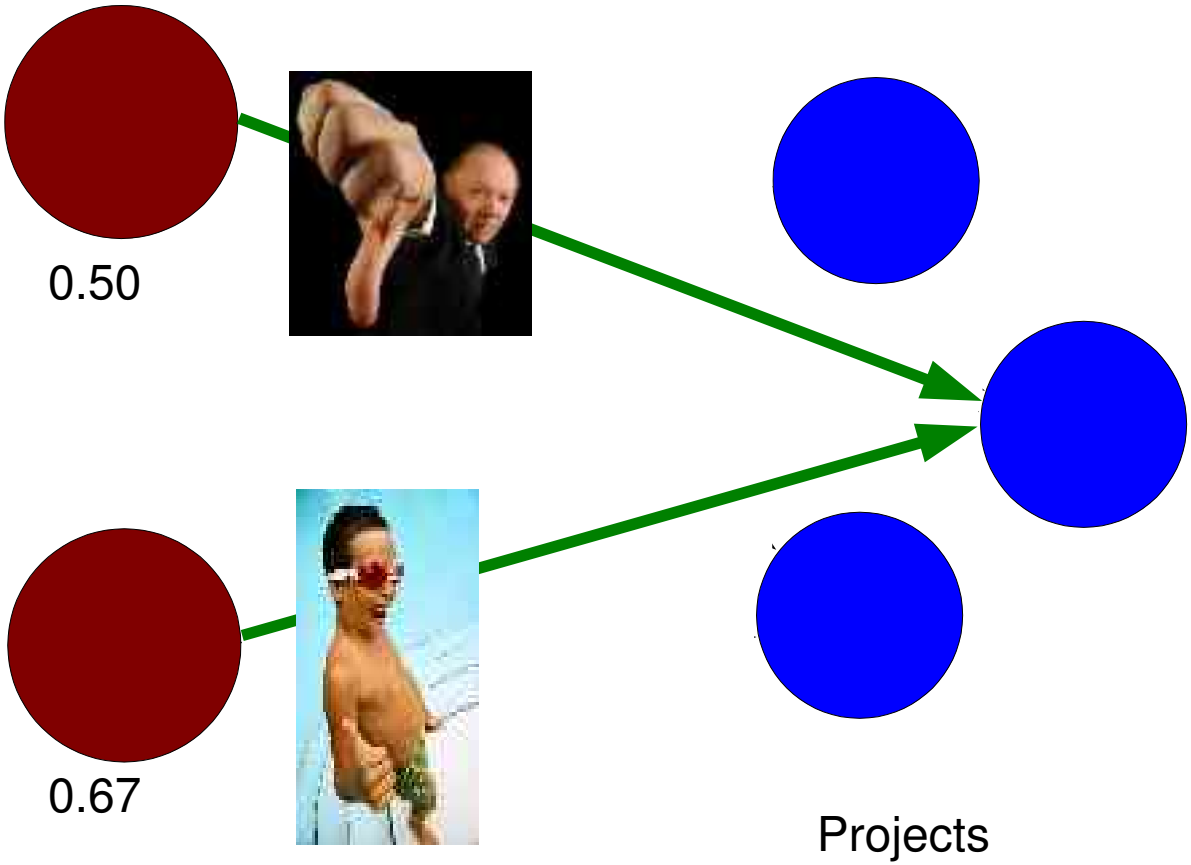
OSSim

- Initially, people associate with project that gives highest fitness
- Each tick, agents that can modify the project, make some random modifications
  - Increase fitness of one phenotype and decrease fitness of another
  - Example: Emacs is great editor, but a lousy web browser
- People vote on which modifications to accept
- Cycle repeats per simulation parameters
- If too long goes without improvement
  - Tolerance decreases
  - More likely to switch to another project

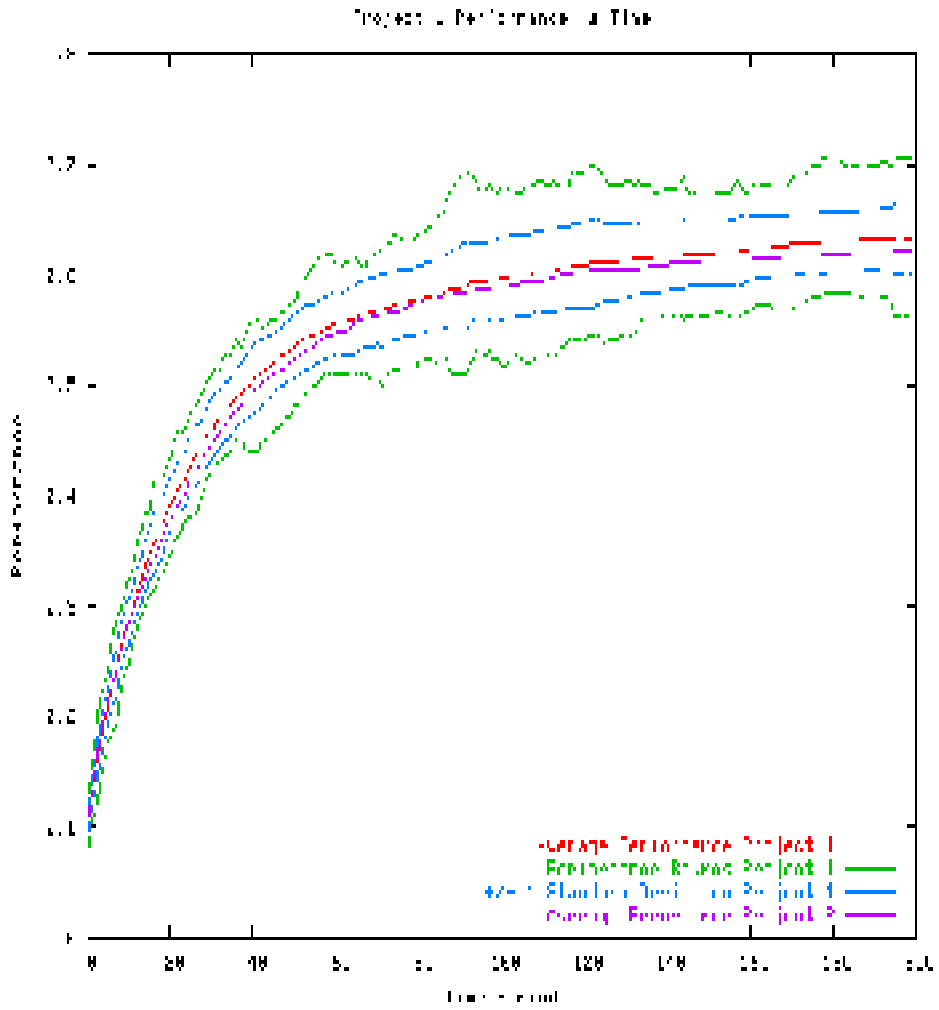
The OSSim Process

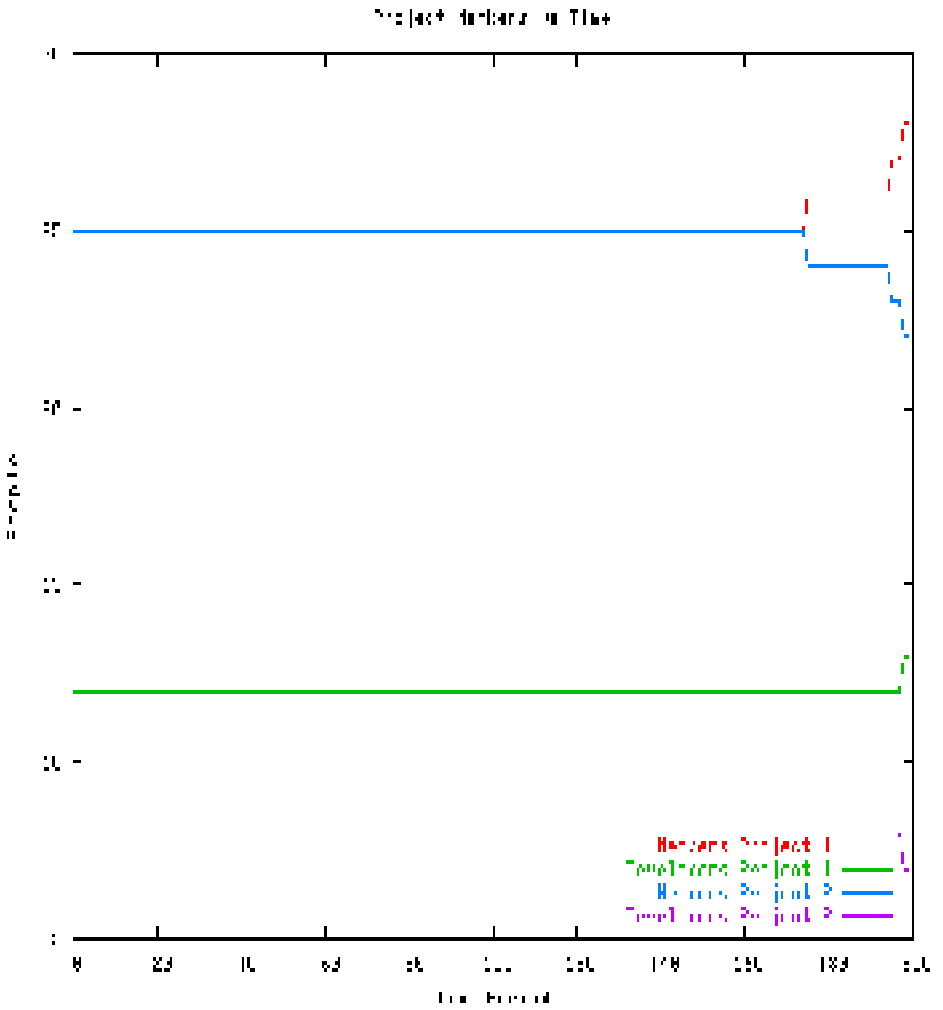
Cycle repeats until terminated

Agent 1
Developer
Skill 30
021211112220112

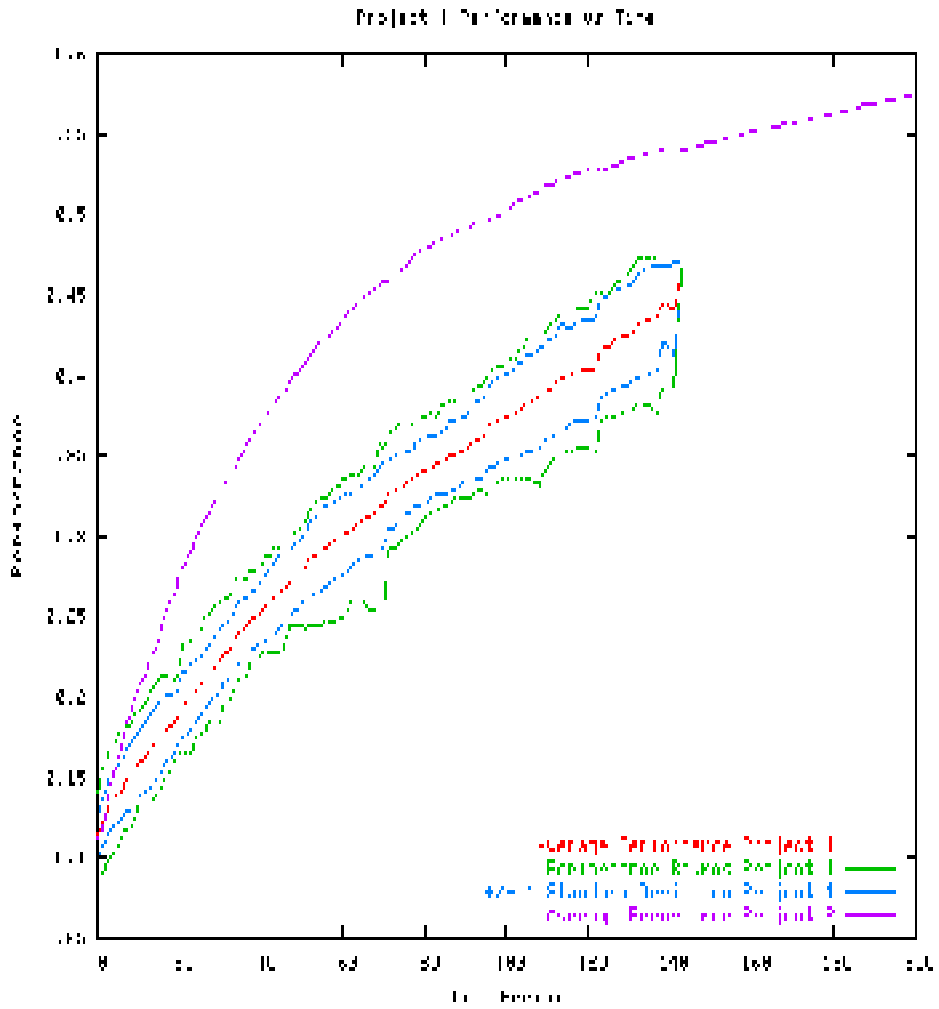


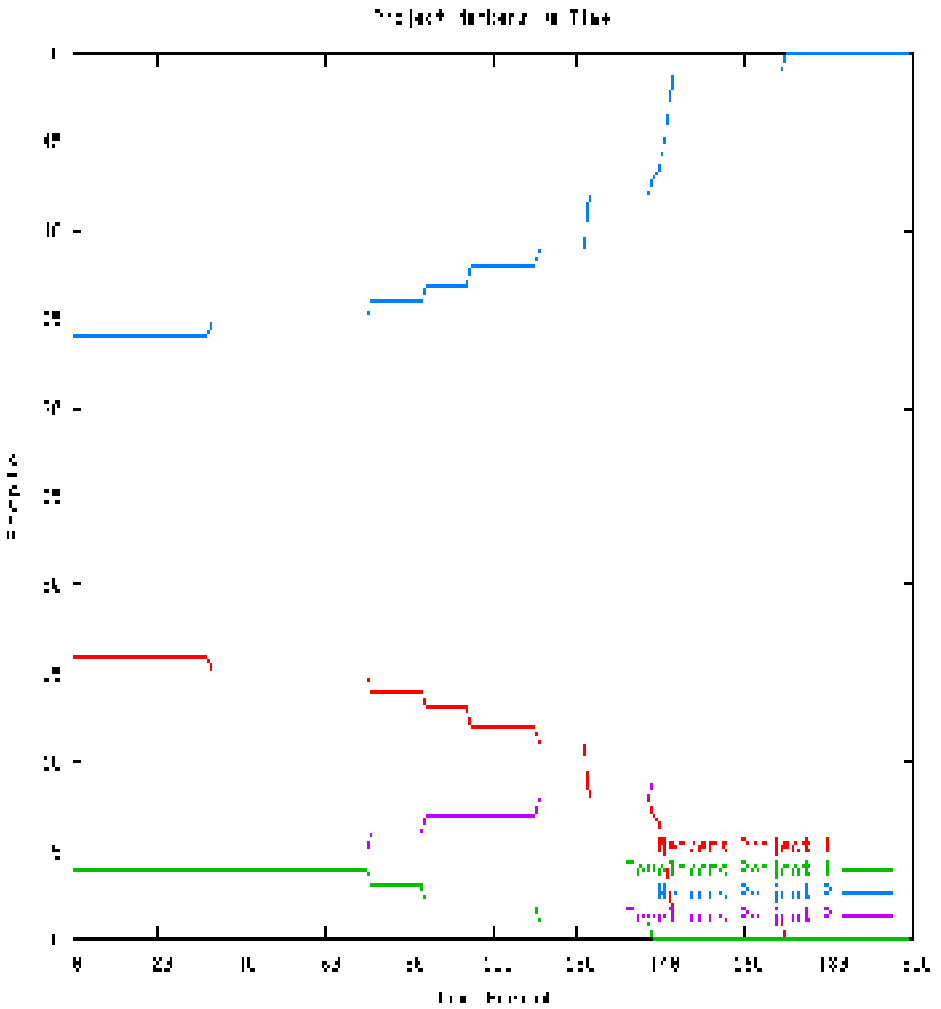
Basic Results





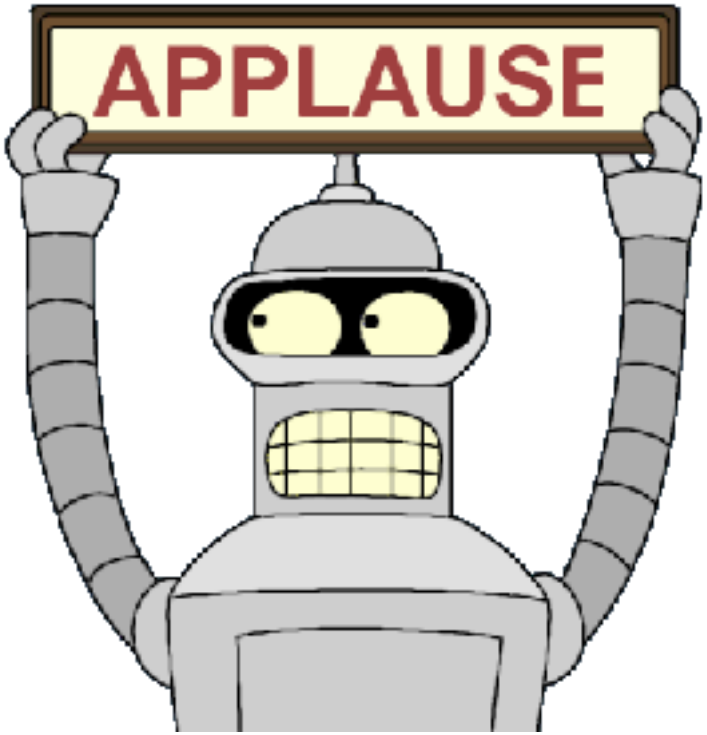
Abandon Ship!





In The Future...

- Validation, Validation, Validation
  - Face validity currently
  - Have data from OSS projects, need to code it
- Improved social networks
  - Preliminary concept of friendship has been integrated
  - Knowledge obtained about new projects from friends
- Integration with other CASOS tools
  - Export data in DyNetML
- More realistic developers


APPLAUSE