Motivation of Software Developers in Open Source Projects

An Internet-based Survey of Contributors to the Linux Kernel

Motivation of Open Source Projects

- Explores the motivation of people that spend considerable time and effort in OSS projects “for free”
- Better understanding of motivational processes might help to improve software development process in other OSS projects as well as in the corporate world

Introduction to OSS and Linux kernel

- "Open Source Software" coined in order to enhance the acceptance of OSS by software companies (vs. Free Software)
- Linux kernel currently contains about two million LOC

Structural Conditions of Successful OSS Development

1. a general culture in which authority comes from competence
2. Delegative and participative leadership principles combined with clear responsibilities
3. A modular project structure that decreases unnecessary complexity
4. A parallel release policy that simultaneously enables rapid development and a stable working system
5. A motivating credit policy that not only acknowledges the contributions of developers, but also, for instance, documentation work.

Relevant Models from Social Science

- Social researchers have explored motivational processes of persons who voluntarily engage in social movements such as the civil rights movement and the labour rights movement
- Social movement : “effort[s] by a large number of people to solve collectively a problem that they have in common”
- Paper uses two models: Extended Klandermans model (EKM) and VIST Model

Extended Klandermans Model (EKM)

- Collective motives
  - Based on the evaluation of the movement goals weighted by the perceived likelihood that these goals are satisfied
- Social motives
  - Expected reactions of significant others such as friends and family
- Reward motives
  - Expected costs and benefits

EKM

- Persons not only weight costs and benefits when they decide whether they want to be involved in a social movement, but that they also feel and define themselves as members of a specific group related to the social movement and behave according to the norms and standards of this group
- Identification with more specific subgroups are a better predictor of willingness to contribute to the social movement than identification with the movement as a whole

VIST Model

- Stems from research on motivational processes in small work teams
- Teams might exist for OSS subsystems (Kernel modules)

VIST Model

- **V**alence
  - Subjective evaluation of the team goals
- **I**nstrumentality
  - The perceived importance or indispensability of one's own contributions for the group outcome
- **S**elf-Efficacy
  - Team members' perceived capability of showing the required activities for the team tasks
- **T**rust
  - Expectancy of team members that their efforts will be reciprocated and not exploited by other team members and that the electronic support system works reliably

The Sample

- 144 participants
  - 6 female, 135 male
- Mean age 30 years
- Range 16-54
- Developer group
  - Active Linux kernel developer or maintainers of a module
- Interested readers group
  - Readers of the Linux kernel mailing list

Results

- Participants identified highly both as a Linux user and as a Linux developer, indicated high pragmatic, norm-oriented, social/political, and hedonistic motives, and valued time losses due to Linux-related activities rather low
- Developer group spent significantly more hours per week on Linux development, and showed significant higher willingness to be further involved in Linux development
- Developers showed lower identification with the Linux community in general, but significantly higher identification with more specific categories such as developers or a specific subsystem

Results

- Participants spent more hours on Linux-related activities when they identified with specific categories (Linux developer, subsystem, modules)
- The higher participants perceived personal rewards for their Linux engagement, the more they were willing to be involved in Linux-related activities in the future
- Analysis of participants who received payment and participants who received no payment did not lead to different results of the main regression analyses

Results

- Most important predictors for the participants' engagement were:
  - A more specific identification as a Linux developer or with a subsystem
  - A considerable tolerance in respect to time losses due to Linux development activities
  - A rather pragmatic interest in personal advantages due to improving the Linux kernel quality

Results (VIST)

- Developers spent more time on Linux development when they felt that their contribution was highly important for the progress of the subsystem
- Developers were willing to spend more time in the subsystem the higher they valued its goals and the higher they perceived their contributions as important for the project success
- Results showed that motivational processes in virtual teams as specified by the VIST model can also be observed in the Linux development process
- Trust, or fear of being exploited, played only minor role

Results – Satisfaction and Working Climate

- Developers were generally quite happy with the working processes
- Developer group more often indicated that they had experienced "burnout" during their Linux-related work

Conclusion

- Main motivational factors
  - A more general identification factor as Linux user
  - A more specific identification as a Linux developer or with a Linux subsystem
  - Pragmatic motives related to the improvement of one's own software and career advantages
  - Norm-oriented motives related to reactions of relevant others (family, friends)
  - Social and political motives related to supporting independent software and working within the Linux community
  - Hedonistic motives such as pure enjoyment of programming
  - Motivational obstacles related to time losses due to Linux-related activities

Conclusion

- Lack of time is one of the biggest obstacles for participating in the Linux kernel project

Other Papers

- FLOSS Report http://www.infonomics.nl/FLOSS/report/
  - Programmer can signal his coding abilities by participating in Open Source projects
  - Raise his expected future wage or give him access to programming jobs (Raymond considers this as rare and marginal motivation for most hackers)