An Empirical Illustration to Validate a FLOSS Development Model using S-shaped Curves

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Motivation

• OSS/FLOSS $\rightarrow$ An **homogeneous** phenomenon?

• FLOSS based software solutions $\rightarrow$ **Applicable** to other types of software?

• Need for: A well established Development Model for FLOSS
A FLOSS Development Model

The Adapted Staged Model for FLOSS [Capiluppi et al., 2007] (ASMF):

• Adaption of the Staged Model [Rajilich and Bennet, 2000]
  – Takes into account various maintenance tasks

• Built upon observations from various cases studies:
  – FLOSS and
  – Traditional development
The Adapted Staged Model FLOSS

ASMF

Initial Development

Some projects maybe never leave this stage

Evolution

Long-lived SW

Continuous feedback → Bug Fixing, Improvements, New Requirements

Servicing

Mature System → Only fixes, its size does not change overall (stabilization points)

Phaseout

No fixes, nor new implementation occur

Closedown
## Approach

### How to validate the ASMF?

<table>
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<tr>
<th>Stage</th>
<th>LOC</th>
<th>Fixed Bugs</th>
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- Fast growth
- Slow growth
- Stabilization
Approach
How to identify the different ASMF stages?

• Evolution of Selected Metrics using S-Shaped Curves

• Growth Rates comparison
Approach
S-Shape Curves

\[ G(m) = \frac{\kappa}{1+e^{-(\alpha+\beta t)}} \]

\( \kappa: \text{Limit of Growth} \)
\( \text{Midpoint} = -\alpha/\beta \)
\( \Delta t = \ln 81/\alpha \)
Case Study

• Four releases of Apache Ivy 2.0 → 2.3
• History Logs:
  – Code Repository
  – Issue Tracking System
• Daily dataset, per Java file:
  – LOC
  – Fixed Bugs, Improvements and New Features
Results and Observations
Ivy 2.0 (1330 Days)

Analyzing $\kappa$, $\Delta t$ and the MidPoint:

- **LOC** and **Improvements** grew faster
  $\rightarrow$ 90% of its total growth @ day 1302 and 1243

- **Fixed Bugs** and **New Features** grew to a slower rate
  $\rightarrow$ 50% of its total growth @ day 955 and 1167
Conclusion for
Ivy R 2.0 (1330 Days)

- The initial development → [Initial Development]
- The latest development → [Evolution]

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- **Fast growth**
- **Slow growth**
- **Stabilization**
General Observations and Conclusions

Initial Development

Evolution

Servicing

Phase Out

Servicing

R 2.0

R 2.1

R 2.2

R 2.3

Day 0

Day 2792

Not considered in the ASMF

Some New Features implemented at [Servicing]

Some New Features

fixed bugs

new features

improvements

Day 0 - Day 2792

LOC

Fixed Bugs

New Features

Improvements

Ivy 2.3

CSM 2013
Summary

• An illustration of an empirical method to validate the ASMF
  – 4 selected metrics
  – S-Shaped curves
• Successfully identified different development stages of 4 releases of Ivy
• Two observations did not comply with ASMF
  – [Servicing] → [Evolution]
  – Small number of Improvements at [Servicing]
Thank you for listening!

Questions/Comments?

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