National Academy of Sciences and Engineering

Committee on Assessing the Impact of Changes in the IT R&D Ecosystem:

Panel: Emerging IT Platforms

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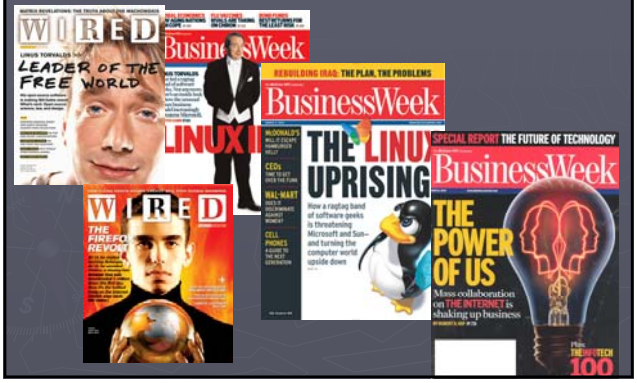
Unpacking the Hype



3 Main Points

1. **The OS model has matured to a triadic role structure –** and now includes formalized governance structures, non-profit foundations and a growing commercial ecosystem.
2. **Hybrid models are emerging, but independence, access and investment affect ecosystem development** – Building an ecosystem requires investment of resources & divestment of control. Without independence or access, ecosystem growth is less likely.
3. **Little assessment has been done on the dynamics of 'Competing on a Common Platform'** – common open source software 'ingredients' are shifting software firms' sources of competitive advantage from IPR to knowledge, service, & temporal advantages

1) Maturation of the OS Model

Maturation of the OS Model

"People have this idea, in the open source world, that things are self-organizing…

It's like the mythology is, we are hackers, we do this stuff and we don't need marketing weenies and we don't need an organizational structure or an organizational chart,

because we are a meritocracy and we hash things out by ourselves. Well, actually that's not what happens…"

(Sponsored Contributor, GNOME Project)

Open Source Software: Then and Now

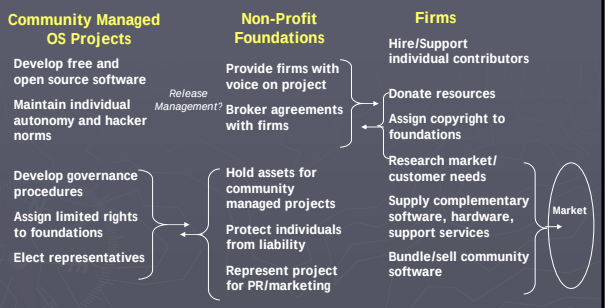
(1993-2000)

- Self-governing volunteer contributors
- Motivated by ideology and idealism
- Donated time and software to advance a cause

(2000 - 2007)

- 50-70% of 'volunteers' sponsored by vendors (David et al, 2003; Ghosh et al, 2002; Henkel, 2006)
- Corporate in-kind donations (legal, marketing, hardware) support production & distribution
- Most commercial grade projects have incorporated as non-profit foundations with formal governance

A Triadic Role Structure



Free Software Foundation - publishes GNU GPL and defines what is free software

Open Source Initiative - certifies what is an open source license

2) Hybrid Models are emerging…… but independence, access and investment affect ecosystem development

Community Managed OS Projects

- Founded by one or more individuals
- Not guided by employment relations
- Firms cannot belong as members
- Sponsored individuals can represent firms
- Are 'community managed' with self-managed or representative governance models
- Have been the focus of most scholarly research
- Examples: Apache, Gnome, Debian

Sponsor Founded OS Projects

- Are founded by an incorporated sponsor
- May be spun out from proprietary projects or initiated by a consortia of firms
- Firms can be members, act as direct sponsors or retain controlling interest
- Some allow individuals to belong
- Have either employment or formal governance model
- *Are less well understood*
- Examples: Mozilla, OpenOffice, Eclipse

Sponsored Projects Studied

Date	Project	Founder
1983	Sendmail	Sendmail
1990	Berkeley DB	Sleepycat
1995	MySql	MySQL AB
1997	PHP	Zend
1998	Mozilla	Netscape
1998	Jikes	IBM
1999	Darwin	Apple
2000	OpenOffice	Sun Microsystems
2001	Eclipse	IBM
2002	Helix	RealNetworks
2003	Chandler	Open Source App. Found.
2004	Sugar	SugarCRM

Access Affects Ecosystem Growth

- All sponsored projects offered transparency – in source code and process
- 5/12 offered commit rights to external parties
- 2/12 offered community release authority
- 1/12 offered external membership (Eclipse)
- Access was perceived to affect ecosystem growth and development

Why no access?

- Firms did not value the contributions an external development community could provide
- Firms needed control over development as product lines were closely coupled
- Many firms gain marketing benefits from being open source and are satisfied with that

'Open' source code and transparent processes are insufficient for building a community or ecosystem

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Eclipse: A Hybrid Form

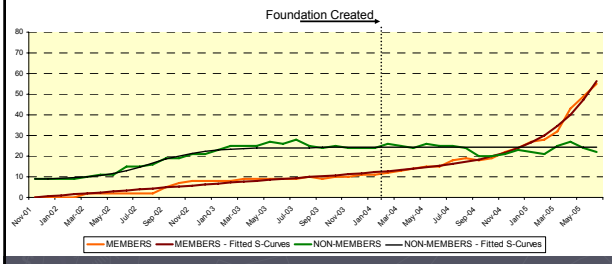
Elements of an open source project

- Committer status is merit based — voted in by other committers
- Projects are developed in a public (transparent manner)
- Open source license (royalty free)
- Committer status is affiliated with the person not the firm
- Committers at large have board representation indexed to corporate representation
- The best solution wins — vendor neutrality sustained

Elements of a consortium

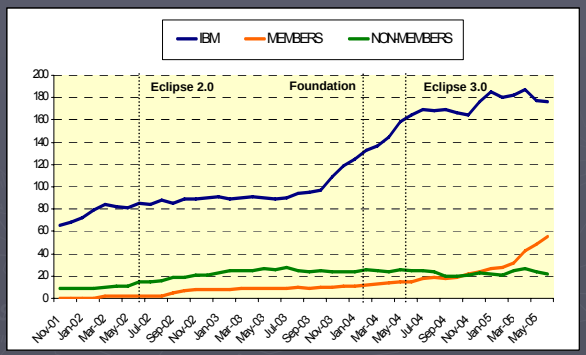
- Corporate membership is on a paid basis ($250k) or 6 FTEs
- Companies can lead a project and introduce new members
- Project charter initiation authorized by the board
- Board representation weighted to paying members
- Requirements, Planning, and Roadmap councils have formal requirements — there is a project roadmap

Independence Affects Ecosystem Growth



Member growth had flattened prior to the creation of an independent entity

Growing an Ecosystem Requires Investment



'Active' Committer Growth

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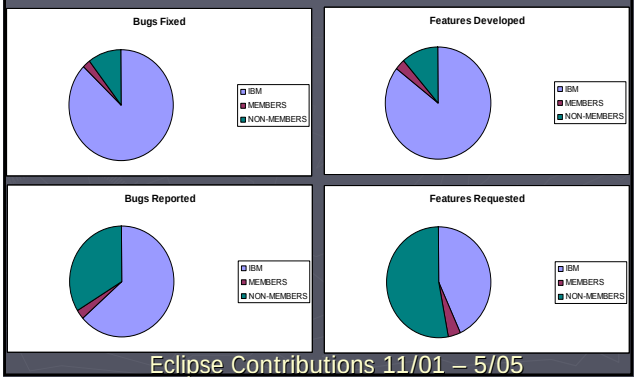
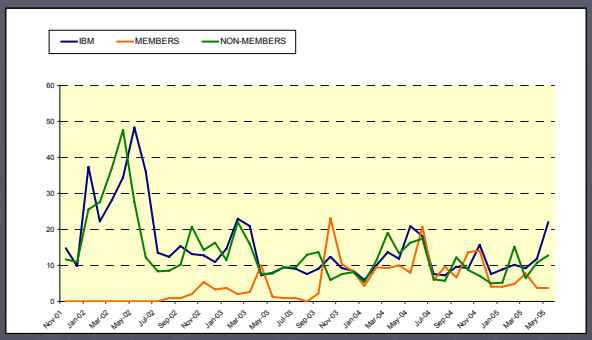


Eclipse Contributions 11/01 – 5/05

Growing an Ecosystem Takes Time

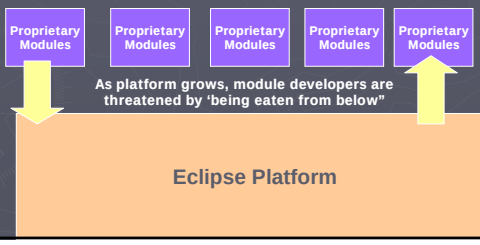


Mean Bugs Fixed Per Person

Eclipse Ecosystem Now

Managing Unintended Consequences of Cooperation

"So, I should be able to look at the roadmap and go well my next new product idea is X, and I don't see X anywhere. So, I should be okay with product X for at least six-months" (Add-in Provider, February 8, 2005)



3) Competing on a Common Platform

Open Source as Strategic Weapon

"Setting up an open source project competing with an established closed source market leader's product is much less risky and carries a significantly higher chance of success than before.

But it's not just a specific system integrator that will want to do that. It's pretty much everyone who isn't the closed source market leader." (Riehle, 2007, *SAP Research*)

Types of OS Business Models

- **Service and maintenance** – contracts for software including testing of each release, certifying patches, certifying integration with other OS products, phone support (e.g. Novell)
- **Professional services** – consulting on strategy, planning, systems integration, customer specific solutions (e.g. IBM)
- **Software as service** – deploying open source sw as part of a hosted service offering, where the customer pays by a per-month or per-transaction model (e.g. Red Hat)
- **Advertising** – revenue supports OS products (e.g. Mozilla/Firefox)

New Sourcing Models

- **Software in product (Embedded)** – hardware manufacturers using OS as an ingredient to consumer or enterprise material products (e.g. Motorola, Nokia) (new s
- **Creative consumption** – using OS to achieve execution advantages (e.g. Google)

Effect of OS Diffusion on IT Integrators

- ↓ Decreases software licensing costs
- ↑ Increases profit margins
- ↑ Expands range & type of customer reached
- ↑ Increases dependence on skilled labor
- ↔ Shifts source of competitive differentiation from IPR to execution, skill, and knowledge capabilities

Effect of OS Diffusion on Software Firms

- ↑ Open source alternatives increase competition, choice
- ↓ Reduce time to recoup investment in closed source software - IPR as source of competitive advantage for shorter duration
- ↑ Increase pressure to innovate and 'move up the stack' to create value added applications at a faster rate
- ↔ Developing new sources of competitive advantage - temporal advantages; specific competencies; customer data, relationships; software as service
- ↔ Partnering with integrators and hybrid OS models
- ↔ Developing dual source models – 'proprietary on top'

Effect of OS Diffusion on Embedded Market

- 75% of 268 embedded Linux developers surveyed work for firms
- OS SW does not destroy source of competitive advantage – firms engage in selective revealing and only share about ½ of their code – compliant with letter but not spirit of OS licenses (device manufacturers reveal less)
- Most OS code revealed is generic and can be used by other firms – hardware firms code more likely to be firm specific
- Smaller firms more likely to reveal code - Experience with Linux and OS over time enhances propensity to reveal code
- Firms who gain more from external development more likely to reveal code than firms who are in OS for marketing effects

(From Henkel, 2006)

Effect of OS Diffusion on IT Labor Market

- Programmers maintain less firm-specific knowledge which can reduce switching costs (may increase turnover, decrease structural unemployment)
- Provides firms with greater visibility into niche technical labor markets
- OS Firms may become dependent upon committers - who help firms ally with communities & are critical to OS business model success
- But they take their expertise, & project status with them (O'Mahony, 2005) and committers may be paid more as a result (Hann et al, 2004)
- Increased reliance on OS may reinforce free agent trend in IT sector (e.g. Barley and Kunda, 2004), increasing fluidity of labor market

Research Questions

- Platform based ecosystems do not grow without resources and strategic intent – *what technical areas can benefit from this type of collaboration?*
- Platform based ecosystems can entrain an entire industry – *how do participating firms 'move up the stack' and stay competitive? Do all boats rise or do some firms have to row harder?*
  - How might platform and ecosystem evolution vary in vertical markets? (e.g. healthcare)
- Firms will not collaborate on shared platforms without some assurance of independence - *How does the collective management of platforms differ from 'platform leadership'? How does anti-trust law inhibit?*
- Boundary organizations foster collective platform management - *What role do boundary spanning organizations play in fostering community/firm collaboration? How can they be supported effectively? What role should govt play?*

- EXTRA SLIDES

Who Contributes? - Summary

- **Bug reporting on all projects**
  - IBM reports more bugs that everyone else combined
  - Individuals & non-members are the 2nd source of bug reports
  - **Member differences in per person output narrow over time**
- **Bug fixes on all projects**
  - IBM fixes more bugs than everyone else combined
  - **Member differences in per person output narrow over time**
- **Enhancements on all projects**
  - Non-members request more enhancements
  - IBM contributes more enhancements than everyone else combined
  - Requests for new features per person are not significantly different by member category
  - **New feature development is primarily done by IBM – member differences do not narrow over time**

Contribution Data – Major Findings

- Bug reporting on all projects
  - IBM reports more bugs that everyone else combined
  - Individuals are the 2nd source of bug reports
- Enhancement requests on all projects
  - IBM is the top enhancement requestor
  - All others combined generate more enhancement requests than IBM
- Bug fixes on all projects
  - IBM fixes a lot more bugs than everyone else combined
- Enhancement contributions on all projects
  - IBM contributes a lot more enhancements than everyone else combined
- The BIRT Project is an exception!
  - BIRT (Business Intelligence And Reporting Tools)
  - Actuate leads the project

What do companies find in Eclipse?

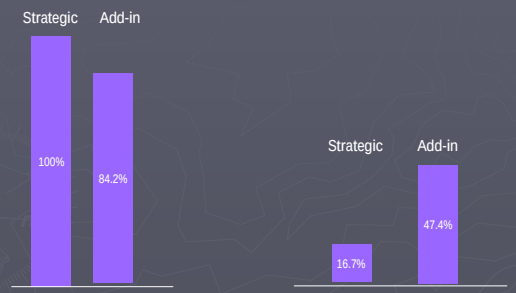
Top benefits companies experience after joining the Foundation

	Expected		Realized	
Benefit	Add-in Providers	Strategic Members	Add-in Providers	Strategic Members
Enhance functionality of their products	57.9%	66.7%	57.9%	83%
Enhance product extensibility and market scope	42.1%	50%	52.7%	50%
Influence the platform	15.8%	33%	15.8%	33%
Image	21.1%	16%	36.9%	0%

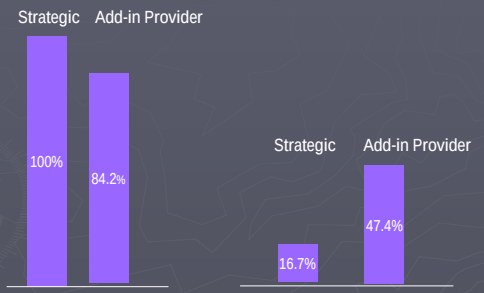
(Percentages of respondents ranking the benefit as one of their top-3 reasons to join, or one of the top-3 benefits experienced)

Impact of Eclipse on level of functionality and rate of product introduction

All companies are leveraging Eclipse to offer more functionality in their products
Add-in providers are 3 times more likely to introduce products faster than strategic members



How do members benefit?



Why do firms join Eclipse?

Top Reasons	Add-in Providers	Strategic Members
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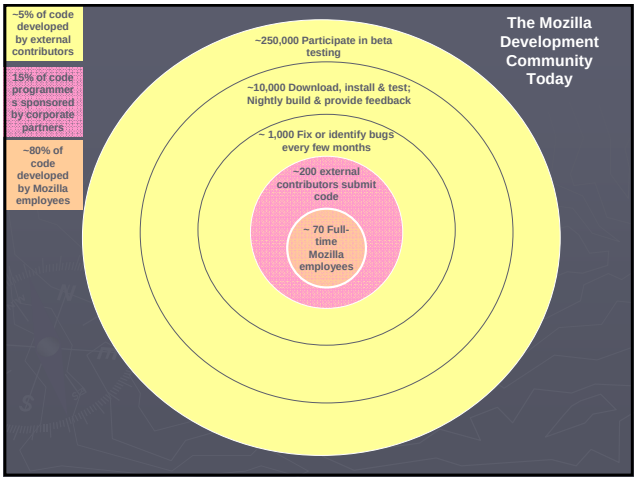
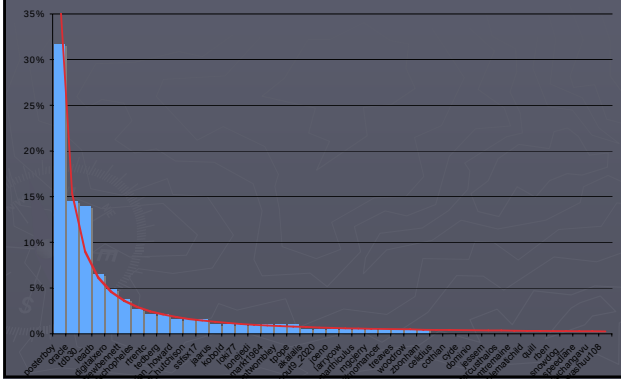


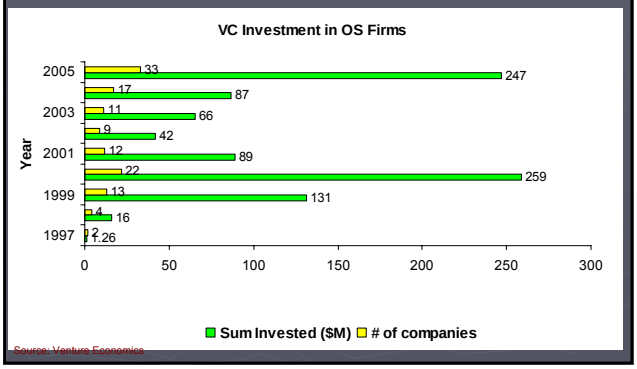
So much by so few....



Adapting & Diffusing the OS Model

- **Adapting the Model** — Firms, governments (Denmark, China, Brazil) and transnational organizations (EU, UN) are starting their own open source software projects
- **Diffusion of the Model** — Open source projects developing more end user applications and applications for vertical markets
- **Diffusion of Corporate Usage** — More traditional organizations and governments are using open source software
- **Diffusion of Capital** — More venture capital is dedicated to funding open source business models

Diffusion of Capital

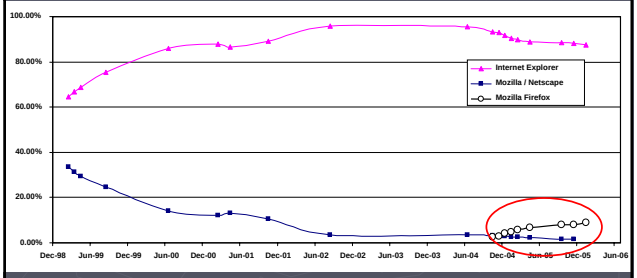


Source: Venture Economics

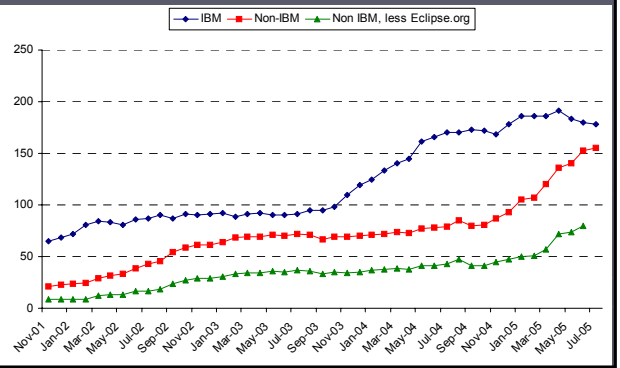
Diffusion Throughout the Stack

Desktop	Open Office, Gnome, KDE, Firefox, Chandler
Databases	MySQL, Sleepycat
Customer Relationship Management, ERP	SugarCRM, Compiere
Inventory Management	OpenMFG
Health care Management	VistA
Instant Messaging	Jabber
PBX	Asterisk
Development Tools	Eclipse
Network monitoring	Nagios
Virtual Machine	Xen
Router	XORP
Web Servers, Application Servers	Apache, JBoss
Operating Systems	Linux, BSD

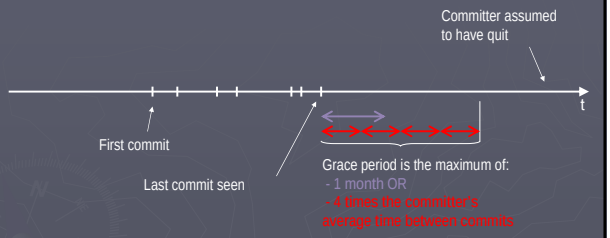
Mozilla/Firefox Market share



Growing Diversity of Committers



When is a committer considered "active"?



Observation: since committers make changes very often, it is quite evident when they stop committing