Open Collaboration: The Eclipse Way

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Agenda

• Open source, open collaboration
• Collaboration, the Eclipse way
• Research and open collaboration
Software Is Eating the World
Software Embedded on Airbus Aircraft

![Diagram showing the growth of software embedded on Airbus aircraft over the years. The x-axis represents the year from 1980 to 2008, and the y-axis represents the size in MB. The size increases significantly over time, from 0.004 MB in 1980 to 108 MB in 2008.](image-url)
90% of automotive innovations are from software

Mercedes S-Class
Infotainment Subsystem
20 Mio. LOC

50 – 100 networked ECUs
Software Matters to Industry
“Every industrial company will become a software company”

“Every software company is an open source company.”
Open Source Maturity Model

0. DENY

1. USE

2. CONTRIBUTE

3. CHAMPION

VALUES APPROPRIATED

TIME

SCOPE

ENGINEERING DRIVEN

BUSINESS DRIVEN

SINGLE PROJECT

MULTIPLE PROJECT

VALUE CO-CREATION

VALUE APPROPRIATION

COUPLING MANAGEMENT
Agenda

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But What is “Open Source”?

Software Freedoms

Freedom 0
to run the program,
for any purpose

Freedom 1
to study how the program works, and change it to
make it do what you wish

Freedom 2
to redistribute copies

Freedom 3
to distribute copies of your
modified versions to others
Transparency
Openness
Meritocracy
Why Open Source?

• Better, smarter business
  – Save costs, faster time to market, improve quality

• Enables collaboration
  – Consistent sharing of IP

• Rapid adoption of technology
  – It is free and easy to access

• Scale
Internet/Cloud/IoT Scale

The Internet Of Everything

BI INTELLIGENCE

Connected Cars
Wearables
Connected TVs
Internet Of Things
Tablets
Smartphones
PCs

Source: BI Intelligence Estimates

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Enabling Developers

THE NUMBER OF IOT DEVELOPERS 2014–2020

Source: VisionMobile estimates, 2014

Report: IoT: Breaking Free From Internet And Things | vmob.me/IoT
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The Power of Developer Choice

Distribution of API protocols and styles

Based on directory of 3,200 web APIs listed at ProgrammableWeb, May 2011
A Current Example

Google Trends for “MQTT”

Open sourced here
There Is No Money In Software

The Price of Software

Computer software is now 0.7% of its price in 1980

Source: U.S. Bureau of Economic Analysis
Open Source enables:

- Permissionless innovation
- Innovation through integration
- Far higher levels of experimentation
The Community is the Capacity
Open Source Questions

• Is Open Source chaotic?
• How does development really work?
• What is this “Open Source community”? 
• How do you manage community contributions?
• How do you plan in Open Source?
• Isn’t open source going to infect our intellectual property?
• Why would we open source our assets?
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A Brief History of Eclipse

- Launched by IBM in 2001
  - Initial release of the Eclipse technology platform (Platform, JDT, PDT)
  - Founding consortium board comprised Borland, IBM, Red Hat......

- Eclipse Foundation formed in 2004
  - Independent not-for-profit organization formed in 2004
  - Definition of bylaws, membership model, initial IP process

- Eclipse Foundation today, 2017
  - Members include IBM, Oracle, SAP, CA, Red Hat, Google, Bosch, Ericsson, etc.
  - 240+ members, (12 strategic members), ~1400 committers
  - 320+ Open Source Projects
  - Industry-focused working groups in Science, LocationTech, IoT and Systems Engineering
  - 27 staff
Community of Projects

Over 320 Projects!
Predictability

Simultaneous Release Metrics

- Projects
- Million LOC
- Commits x1000
- Authors x10
- Committers x10
- Contrib x10
- Companies

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Building blocks for open collaboration
Governance

- Who and how are decisions made?
- Who controls the intellectual property: copyright, trademark, domain names, etc.?
- Does anyone or company have special status or is it a level playing field for all parties?
Infrastrucutre

- A forge to host the development and IP
  - Code repositories
  - Bug database
  - IP Management database
  - Web sites, wikis
  - Download mirrors
  - Build and release management
IP Management and Licensing

- Consistent and common set of legal agreements that will cover the intellectual property created by the collaboration.
- Software license that allows for downstream commercialization.
- For open source projects, IP Management that ensures license compatibility.
- IP cleanliness to ensure provenance
Projects and Processes

- Development process that enables large-scale distributed development
- Support involvement of many different organizations
- Open source project based on the principles of openness, transparency and meritocracy
Ecosystem Development

- How do ecosystems grow and add value?
- How can all stakeholders participate?
- What are the best practices for creating an ecosystem?
Eclipse Working Groups

• Eclipse is the industry’s best model for vendor-neutral open collaboration

• Eclipse Working Groups:
  – Licensing model for sharing co-developed innovation
  – IP management to maximize commercialization opportunities
  – Project model for coordinating investments and activities
  – Governance model to ensure a level playing field for all participants

_Eclipse gives you these “out of the box”_
Open Source for IoT

IoT needs open source to be successful. Eclipse IoT simplifies IoT development.

Standards
Implementation of IoT standards like MQTT, CoAP, LWM2M and OneM2M

Getting Started
Step-by-step guide to getting started on IoT development

Services & Frameworks
Building blocks to accelerate IoT development

All projects
Check out all our IoT open source projects

Technology
Eclipse IoT provides open source implementations of the standards, services and frameworks that enable an Open Internet of Things.
The 3 IoT Software Stacks

SECURITY

ONTOLOGIES

TOOLS & SDKs

CONSTRAINED DEVICES

GATEWAYS AND SMART DEVICES

IOT CLOUD PLATFORM
The Eclipse Polarsys Initiative


Ludwigsburg, Germany – November 2, 2011 - A new open source industry collaboration, called Polarsys, is being created at the Eclipse Foundation to focus on building and maintaining tools for safety critical and embedded system development. Interested parties in Polarsys include Airbus, Astrium Satellites, ATOS, CEA, CS (Communication & Systèmes), Ericsson, IRT (Institut de recherche en informatique de Toulouse), Inria, Katholieke Universiteit Leuven, Obex, Universidad Politécnica de Valencia, Technalia, Thales, and Xipp. Polarsys will operate as a Eclipse Industry Working Group and be open to any organization interested in participating in the goals of the group.

Systems software development for very long lifecycle products
The PolarSys Working Group

• PolarSys is an Eclipse Industry Working Group created by large industry players and by tools providers to collaborate on the creation and support of Open Source tools for the development of embedded systems.

• Domains such as aerospace, defense and security, energy, health care, telecommunications, transportation must meet several requirements.

• Main projects:
  – Capella, CDT, Papyrus, Titan, Trace Compass
The LocationTech Working Group

- LocationTech is a working group developing advanced location aware technologies

- Main projects:
  - GeoGig, GeoTrellis, GeoJinni, Geomesa, uDig
The Science Working Group

- The Science Working Group (SWG) works to solve the problems of making science software inter-operable and interchangeable.
  - Develop reusable open source software for scientific research
  - Enable a collaborative approach to producing technologies used for interdisciplinary analysis of scientific data
  - Group efforts help permeate concepts and capabilities to different research areas which allows serendipitous discoveries to be made.

- Main projects:
  - Apogy, ChemClipse, DAWN, ICE, XACC

Steering Committee

Participating Organizations
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Issues in Research

• Lack of dissemination / commercialization
• Reinvention vs. experimentation
• Closed collaboration models
• Open source can help these....
  – Direct commercialization, or
  – Throughout the research lifecycle
The Tasktop Story

Mylar Highlights: 2004-2007

2004  Mylar invention & innovation
2004  1st industrial trial at IBM Toronto
2005  1st academic publication
2005  EclipseCon/Field Study/Eclipse project
2005-06 Company discussions; biz competitions
2007  Mik’s Ph.D. Friday; incorporate Monday

............
The Tasktop Story

Mylyn/Tasktop Highlights: 2007-2016

2007  Mylar becomes Eclipse Mylyn
2008  Tasktop Dev
2009  Tasktop Dev - Enterprise sales
2011  Tasktop Sync
2014  $11M Series A funding
2015-16 Tasktop Data & Gateway capabilities
The CodeTrails Story

Academic (TU Darmstadt)

• Research idea:
  • Developers spent too much time on reading source code. Mostly because the documentation we have is outdated or incomplete.
  • But the knowledge how to properly use an API manifests itself in source code of applications that already use these APIs
  • If we’d apply static analysis and some machine learning on it, we should be able to extract valuable information for code, and thus, help developers to become more productive.

• Ph.D. Thesis:
  • IDE 2.0: Leveraging the Wisdom of the Software Engineering Crowds [link]

• Research started in 2006 at Software Technology Group (Prof. Mira Mezini), Technische Universität Darmstadt, Germany
The CodeTrails Story

Technology in a nutshell

1. Analyze source code

2. Data-mine code, extract patterns, create recommendation models

3. Deliver mined knowledge to developers

GitHub

Bitbucket

Maven Central
Code Recommenders first tool

@Override
public void create(JPanel parent) {

    JButton button = new JButton();
    button. |Which method will you call next in this situation?
What you really want to see...

```java
setText(String string) : void - Text - 73%
setLayoutData(Object layoutData) : void - Control - 71%
addModifyListener(ModifyListener listener) : void - Text - 48%
```

Press '^Space' to show Chain Proposals (Code Recommenders)
Why we (thought we) moved to Eclipse

1. Because we thought we build the **most** awesome, game-changing tool every developer should know about...

2. We wanted to get real users (not just 10 students) for our case studies to better publish our papers

3. We wanted to learn whether there is enough interest to build a commercial product around the idea

4. We just wanted to be with the cool kids...
Our benefits being at Eclipse

- Code Recommenders
  - Talks, Talks, Talks!
    - 50+ talks e.g. at JavaOne, Java User Groups, DemoCamps etc.
  - Eclipse Community Award 2012 attracted investors
- Being part of the Eclipse Java IDE
  - millions of real users
  - helped to raise research funding (500,000 €)
  - made potential customers aware of Codetrails

- Eclipse Automated Error Reporting
  - Addition to Eclipse IDE and blog posts raised awareness
  - Being part of Eclipse IDE is a door-opener for commercial product
The CodeTrails Story

Codetrails Timeline

- **2006**: Research starts...
- **2009**: Code Recommenders (CR) published
- **2011**: CR becomes Eclipse project
- **2012**: CR joins Eclipse project
- **2014**: Research Grant I founded
- **2015**: 1st commercial product on CR
- **2017**: 2nd commercial product on AERI

Eclipse

Codetrails

- **2006**: Research Grant I
- **2009**: Code Recommenders (CR) published
- **2011**: CR becomes Eclipse project
- **2012**: CR joins Eclipse project
- **2015**: Automated Error Reporting (AERI) published
- **2017**: Investor joined

The CodeTrails Story
Eclipse as a Research Catalyst
Eclipse APP4MC is a platform for engineering embedded multi- and many-core software systems. The platform enables the creation and management of complex tool chains including simulation and validation. As an open platform, proven in the automotive sector by Bosch and their partners, it supports interoperability and extensibility and unifies data exchange in cross-organizational projects.
AGILE
Adaptive Gateways for diverse multiple Environments

• AGILE builds a modular hardware and software gateway for the Internet of Things with support for:
  – protocol interoperability,
  – device and data management,
  – IoT apps execution,
  – and external Cloud communication,

• Featuring diverse pilot activities, Open Calls & Community building
AMASS

- Architecture-driven, Multi-concern and **Seamless Assurance and Certification** of Cyber-Physical Systems
- AMASS will create and consolidate a de-facto European-wide assurance and certification open tool platform, ecosystem and self-sustainable community spanning the largest CPS vertical markets.
- It will start by combining and evolving the OPENCOSS and SafeCer technological solutions towards end-user validated tools, and will enhance and perform further research into new areas not covered by those projects.
BASYS

• The goal of the project is the creation of a platform ('Basissystem') to manage future production plants.
• To solve variability issues of the production process which has been identified as one of the core challenges of the 4th industrial revolution.
• The concepts of capabilities (of equipment or plants), components of equipment or plants, IT-Services, intelligent devices and functions will be considered to create a holistic data model flexible but standardized runtime platforms real-time instruments for production planning and conversion (of equipment and plant) flexible production management code
CROSSMINER

- CROSSMINER will automatically **extract the knowledge** from OSS projects and **inject it into the IDE** of the developers, at the time they need it to make their design decisions.
- This allows them to reduce their effort in knowledge acquisition and to increase the quality of their code. CROSSMINER uniquely combines advanced software project analyses with online monitoring in the IDE.
- The developer will be monitored to infer which information is timely, based on readily available knowledge stored earlier by a set of advanced offline deep analyses of related OSS projects.
RobMoSys

- **RobMoSys** will coordinate the whole community’s best and consorted effort to build an open and sustainable, agile and multi-domain European robotics software ecosystem.

- **RobMoSys** envisions an integration approach built on-top-of, or rather around, the current code-centric robotic platforms, by means of the systematic application of model-driven methods and tools that explicitly focus on system-of-system integration.
Launched in 2017

Supporting coordinated use of modeling languages leads to what we call the globalization of modeling languages, that is, the use of multiple modeling languages to support coordinated development of diverse aspects of a system.

An Eclipse package on top of Eclipse modeling, with EMF, Sirius, Xtext, Xtend, Acceleo, ...

Currently hosted at INRIA (forge) and GitHub (git)

http://gemoc.org/studio
The GEMOC Community
Current State of Quantum Programming

Treat near-term QPUs as accelerators within a larger HPC environment. How do we program this?

- **Current Problems:**
  - Many QPLs and many QPUs
  - Massive amount of work to map QPL to QPU
- Near term test beds may have multiple QPUs attached to classical HPC cluster
- Nothing familiar here to current domain computational scientists
- None targets HPC environments
Eclipse XACC Specification

Treat near-term QPUs as accelerators within a larger HPC environment. How do we program this?

We have a solution – the XACC(*) Specification:

- **Familiar API and Programming model**
  - OpenCL-like - high-level kernel compilation and execution API
  - LLVM-like - language and hardware agnostic through a well designed intermediate representation
- **Program quantum code once, in your language, and XACC handles the rest.**

(*) eXtreme-scale ACCelerator programming framework
Parting Thoughts...
Our Future is being built on open source
The Community is the Capacity
Get Involved!

WE WANT YOU!!
Thank you!

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