OSS and Its Quality

- Open Source Software (OSS) is no longer an amateur sport
  - huge investments
  - involvement of major software companies
  - ethical reasons
  - political reasons
- Hype and underevaluation
  - both are ideological positions

OSS Trustworthiness
The QualiPSo Project

Motivations
- OSS vs. CSS
- Trustworthiness
- Factors
- Available Data
- Measurement
- Plan
- Testing
- Tools
- Experimentation
- Conclusions
OSS and Its Quality

- Many success cases
- Like with any other product, we want quality
- Nobody expects software to be perfect
  - everybody wants/needs to trust it

Motivations
- OSS vs. CSS
- QualiPSo
- Trustworthiness
- Factors
- Available Data
- Measurement
- Plan
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- Experimentation
- Conclusions

OSS and Its Quality

- We need ways to
  - improve
  - assess
  - maintain
- OSS quality
- Verification and validation address the “primary” software quality
- Other process and product qualities may be very important in OSS
  - acceptance
  - adoption
OSS Quality Models

The QualiPSo Project

- Open Source Maturity Model (OSMM) - Navica
- Open Source Maturity Model (OSMM) - Capgemini
- Business Readiness Rating for Open Source (OpenBRR)
- Qualification and Selection of Open-Source software – Atos Origin
- Open Business Quality Rating (OpenBQR) – Università dell’Insubria

They all come with:
• weighted sums
• steps and processes

OSS Trustworthiness

OSS vs. CSS: Quality Management

Development methodology
• CSS: Well-defined development methodology
• OSS: Development methodology often not defined or documented

Project documentation
• CSS: Extensive
• OSS: Little

Formality
• CSS: Formal, structured testing and quality assurance methodology
• OSS: Unstructured and informal testing and quality assurance methodology
## OSS vs. CSS: Quality Management

### OSS Trustworthiness

The QualiPSo Project

<table>
<thead>
<tr>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Analysts define requirements</td>
</tr>
<tr>
<td>• Programmers define requirements</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Risk assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Formal risk assessment process—monitored and managed throughout project</td>
</tr>
<tr>
<td>• No formal risk assessment process</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Measurable goals used throughout project</td>
</tr>
<tr>
<td>• Few measurable goals</td>
</tr>
</tbody>
</table>

### Motivations

- OSS vs. CSS
- QualiPSo
- Trustworthiness

### Available Data

- Measurement Plan
- Testing
- Tools
- Experimentation

---

## OSS vs. CSS: Quality Management

### OSS Trustworthiness

The QualiPSo Project

<table>
<thead>
<tr>
<th>Use of evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>• CSS: Empirical evidence regarding quality used routinely to aid decision making</td>
</tr>
<tr>
<td>• OSS: Empirical evidence regarding quality is not collected</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Organization of work</th>
</tr>
</thead>
<tbody>
<tr>
<td>• CSS: Team members are assigned work</td>
</tr>
<tr>
<td>• OSS: Team members choose work</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>• CSS: Formal design phase is carried out and signed off before programming starts</td>
</tr>
<tr>
<td>• OSS: Projects often go straight to programming</td>
</tr>
</tbody>
</table>

---

Sandro Morasca
MetriSec, Lake Buena Vista, FL, USA
October 14, 2009

www.qualipso.org
### OSS vs. CSS: Quality Management

**Planning**
- CSS: Much effort put into project planning and scheduling
- OSS: Little project planning or scheduling

**Visibility**
- CSS: Opaque
- OSS: Transparent

**Security**
- CSS: It cannot be assessed
- OSS: Everybody can evaluate it

---

### Transparency

- Transparency is usually a positive thing
  - exposing the problems might not be good advertisement for a product

- Should the quality data not be exposed?

- On the contrary
  - transparency should also be applied to CSS
### QualiPSo

**OSS Trustworthiness**

**The QualiPSo Project**

- QualiPSo (Quality Platforms for Open Source Software) is a project on OSS funded by the European Union
- **Goal:** study the trustworthiness of OSS
  - help industries and governments fuel innovation and competitiveness in today’s and tomorrow’s global environment by providing the way to use trusted low-cost, flexible open source software to develop innovative and reliable information systems.
- Largest project funded by the European Commission under its sixth framework program (FP6), as part of the Information Society Technologies (IST) initiative
- 18 current members, across Europe, Brazil, and China
  - Nov. 2006 – Oct. 2010

---

### Partners

**ICT industry players**
- Atos Origin, Bull, Engineering Ingegneria Informatica, Siemens, Telefonica I+D, Thales

**SMEs**
- Centro Ricerche Matematica Pura e Applicata, European Dynamics, Mandriva

**Governments**
- Department for innovation and technologies of the Italian Presidency of the Council of Ministers
Partners
OSS Trustworthiness
The QualiPSo Project

Motivations
- OSS vs. CSS
- QualiPSo
- Trustworthiness
- Factors
- Available Data
- Measurement
- Plan
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- Tools
- Experimentation
- Conclusions

Research Centers and academics
- Fraunhofer FOKUS, INRIA, Poznan Supercomputing and Networking Center, State University of Sao Paulo, South China University of Technology / Guangzhou Middleware Research Center, University of Bozen, University of Insubria, University Rey Juan Carlos

Structure
OSS Trustworthiness
The QualiPSo Project

Motivations
- OSS vs. CSS
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- Factors
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- Measurement
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- Testing
- Tools
- Experimentation
- Conclusions

Research
- Prototyping
- Instantiation
- Industrialization

A1: Legal Issues
A2: Business Models
A3: Interoperability
A4: Information Management
A5: Trustworthy Results
A6: Trustworthy Process
A7: QualiPSo Factory
A8: QualiPSo Competence Centers
A9: Exploitation & Dissemination
A11: Training
Activity A5: Trustworthy Results
(Product Trustworthiness)

- Goal: study qualities that can sustain trust in open source components
- Study and research functional and technical factors
  - Identification – what are the most pertinent factors?
  - Quantification - what are their added value?
  - Evaluation - what are the good products and components according to these factors?
- Define and implement process and test plans
- Implement validation tools for these criteria
- Partners involved: Insubria University, Mandriva, PSNC, Siemens, GMRC, Sao Paolo University
The Research Approach

1. Find users' goals and trustworthiness factors
2. Find out which trustworthiness factors can be easily assessed
3. Define measures for trustworthiness (the Y's) and measures for its factors (the X's)
4. Test, benchmarks, and dynamic measures
5. Build supporting tools
6. Build OSS product trustworthiness model

Steps 3 – 6 are iterated twice

Trustworthiness Factors

- An empirical approach
- We have interviewed 151 “users”
  - developers, integrators, system administrators, product managers, clearing house members, end users, etc.
- We asked the interviewees to rank the trustworthiness-related factors they use when they select OSS
- We analyzed the interviews in a statistically sound way to find the most important factors
  - we have obtained a ranking among them
<table>
<thead>
<tr>
<th>Factor</th>
<th>Group</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>functional requirements</td>
<td>8</td>
<td>8.588</td>
</tr>
<tr>
<td>reliability</td>
<td>8</td>
<td>8.194</td>
</tr>
<tr>
<td>interoperability</td>
<td>7</td>
<td>7.895</td>
</tr>
<tr>
<td>maintainability</td>
<td>7</td>
<td>7.856</td>
</tr>
<tr>
<td>documentation</td>
<td>7</td>
<td>7.848</td>
</tr>
<tr>
<td>customer satisfaction</td>
<td>7</td>
<td>7.716</td>
</tr>
<tr>
<td>interoperability issues</td>
<td>7</td>
<td>7.588</td>
</tr>
<tr>
<td>modularity</td>
<td>6</td>
<td>7.457</td>
</tr>
<tr>
<td>standard architecture</td>
<td>6</td>
<td>7.424</td>
</tr>
<tr>
<td>standard compliance</td>
<td>6</td>
<td>7.372</td>
</tr>
<tr>
<td>user community</td>
<td>6</td>
<td>7.309</td>
</tr>
<tr>
<td>performance</td>
<td>5</td>
<td>7.337</td>
</tr>
<tr>
<td>user community that witnesses quality</td>
<td>5</td>
<td>7.204</td>
</tr>
<tr>
<td>usability</td>
<td>5</td>
<td>7.196</td>
</tr>
<tr>
<td>short term support</td>
<td>5</td>
<td>6.909</td>
</tr>
<tr>
<td>law</td>
<td>5</td>
<td>6.891</td>
</tr>
<tr>
<td>tools</td>
<td>5</td>
<td>6.844</td>
</tr>
<tr>
<td>environment</td>
<td>5</td>
<td>6.830</td>
</tr>
</tbody>
</table>
### Trustworthiness Factors

#### OSS Trustworthiness
The QualiPSo Project

<table>
<thead>
<tr>
<th>Factor</th>
<th>Group</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>reusability</td>
<td>4</td>
<td>7.033</td>
</tr>
<tr>
<td>portability</td>
<td>4</td>
<td>6.500</td>
</tr>
<tr>
<td>type of licenses</td>
<td>4</td>
<td>6.441</td>
</tr>
<tr>
<td>language uniformity</td>
<td>4</td>
<td>6.181</td>
</tr>
<tr>
<td>localization</td>
<td>4</td>
<td>6.094</td>
</tr>
<tr>
<td>self containedness</td>
<td>3</td>
<td>6.319</td>
</tr>
<tr>
<td>best practices</td>
<td>3</td>
<td>6.232</td>
</tr>
<tr>
<td>security</td>
<td>3</td>
<td>6.214</td>
</tr>
<tr>
<td>complexity</td>
<td>3</td>
<td>5.935</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Factor</th>
<th>Group</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>standard imposed</td>
<td>3</td>
<td>5.899</td>
</tr>
<tr>
<td>patterns</td>
<td>3</td>
<td>5.870</td>
</tr>
<tr>
<td>ROI</td>
<td>3</td>
<td>5.722</td>
</tr>
<tr>
<td>benchmarks / test suites</td>
<td>3</td>
<td>5.677</td>
</tr>
<tr>
<td>maintainer organization</td>
<td>2</td>
<td>5.687</td>
</tr>
<tr>
<td>reputation of vendor</td>
<td>2</td>
<td>5.643</td>
</tr>
<tr>
<td>TCO</td>
<td>2</td>
<td>5.633</td>
</tr>
<tr>
<td>training / guidelines</td>
<td>2</td>
<td>5.081</td>
</tr>
<tr>
<td>size</td>
<td>1</td>
<td>4.163</td>
</tr>
<tr>
<td>distribution channel</td>
<td>1</td>
<td>3.438</td>
</tr>
</tbody>
</table>
**What We also Got from the Questionnaire**

- Trustworthiness factors not originally included in the questionnaire
  - reusability
  - security
- A wealth of additional comments in
  - open questions
  - "wish" questions

---

**Project Selection**

- We wanted projects with different characteristics as for
  - Type of programs and applications (from web servers to operating systems, from libraries to CMS)
  - Programming language
  - Developer community size
  - Software engineering tools used
    - evaluate whether the automation of the development process affects the trustworthiness of the products
  - Product age
Project Selection

OSS Trustworthiness
The QualiPSo Project

- We identified 96 projects
  - 11 projects classified at priority 1 (studied)
  - 21 projects classified at priority 2 (studied)

- The goals are
  - identify what trustworthiness factors are measurable now
  - measure them, if possible

Priority 1 Projects

OSS Trustworthiness
The QualiPSo Project

- Apache httpd (httpd.apache.org)
- Apache JMeter (jackarta.apache.org/jmeter)
- BusyBox (www.busybox.net)
- Drupal (www.drupal.org)
- Joomla (www.joomla.org)
- Linux kernel (www.kernel.org)
- MySQL (www.mysql.org)
- Open Solaris (www.opensolaris.org)
- Servicemix (incubator.apache.org/servicemix)
- SpagoBI (www.spagobi.org)
- Talend (www.talend.com)
### The availability of technical documentation

<table>
<thead>
<tr>
<th>Documentation Type</th>
<th>Values</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical manual</td>
<td>16</td>
<td>50%</td>
</tr>
<tr>
<td>Not Updated</td>
<td>2</td>
<td>6%</td>
</tr>
<tr>
<td>Not Available</td>
<td>14</td>
<td>44%</td>
</tr>
<tr>
<td>Technical documentation (like JavaDoc)</td>
<td>14</td>
<td>44%</td>
</tr>
<tr>
<td>No</td>
<td>18</td>
<td>56%</td>
</tr>
<tr>
<td>Installation guide</td>
<td>25</td>
<td>78%</td>
</tr>
<tr>
<td>Not Updated</td>
<td>2</td>
<td>6%</td>
</tr>
<tr>
<td>Not Available</td>
<td>5</td>
<td>16%</td>
</tr>
<tr>
<td>Technical related FAQ</td>
<td>11</td>
<td>33%</td>
</tr>
<tr>
<td>Not Updated / unknown</td>
<td>7</td>
<td>22%</td>
</tr>
<tr>
<td>Not Available</td>
<td>14</td>
<td>44%</td>
</tr>
<tr>
<td>Technical forum</td>
<td>12</td>
<td>38%</td>
</tr>
<tr>
<td>No</td>
<td>20</td>
<td>63%</td>
</tr>
<tr>
<td>Technical related mailing list</td>
<td>16</td>
<td>50%</td>
</tr>
<tr>
<td>No</td>
<td>16</td>
<td>50%</td>
</tr>
</tbody>
</table>

### The existence of benchmarks / test suites that witness for the quality of OSS

<table>
<thead>
<tr>
<th>Existence of test suites</th>
<th>Values</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>2</td>
<td>8%</td>
</tr>
<tr>
<td>No</td>
<td>30</td>
<td>94%</td>
</tr>
<tr>
<td>Existence of benchmarks</td>
<td>Percentage</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>6</td>
<td>19%</td>
</tr>
<tr>
<td>No</td>
<td>26</td>
<td>81%</td>
</tr>
<tr>
<td>Usage of a test framework</td>
<td>Percentage</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>No</td>
<td>31</td>
<td>97%</td>
</tr>
<tr>
<td>Results of test suite runs published</td>
<td>Percentage</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>No</td>
<td>32</td>
<td>100%</td>
</tr>
</tbody>
</table>
### Are there Any Data out there?

#### OSS Trustworthiness

**The QualiPSo Project**

<table>
<thead>
<tr>
<th>Activity to encourage the community to contribute to quality efforts</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>6, 19%</td>
</tr>
<tr>
<td>No</td>
<td>26, 81%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(Links to) articles on the results of benchmarks</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>13, 41%</td>
</tr>
<tr>
<td>No</td>
<td>19, 59%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Explicitly named individuals or sub-communities which focus on these topics</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>0, 0%</td>
</tr>
<tr>
<td>No</td>
<td>32, 100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Which kind of tests are available</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>performance test</td>
<td>9, 28%</td>
</tr>
<tr>
<td>function test</td>
<td>5, 16%</td>
</tr>
<tr>
<td>unknown</td>
<td>18, 50%</td>
</tr>
</tbody>
</table>

---

### Are there Any Data out there?

#### OSS Trustworthiness

**The QualiPSo Project**

<table>
<thead>
<tr>
<th>Features list</th>
<th>Values</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>poor free text description</td>
<td>13</td>
<td>41%</td>
</tr>
<tr>
<td>incomplete feature list available</td>
<td>6</td>
<td>16%</td>
</tr>
<tr>
<td>comprehensive feature list available</td>
<td>13</td>
<td>41%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Release notes</th>
<th>Values</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>contains features information</td>
<td>19</td>
<td>50%</td>
</tr>
<tr>
<td>No feature information</td>
<td>13</td>
<td>41%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Products examples</th>
<th>Values</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>live</td>
<td>5</td>
<td>16%</td>
</tr>
<tr>
<td>demo</td>
<td>15</td>
<td>47%</td>
</tr>
<tr>
<td>screenshot</td>
<td>10</td>
<td>31%</td>
</tr>
<tr>
<td>none</td>
<td>19</td>
<td>50%</td>
</tr>
</tbody>
</table>
Are there Any Data out there?

OSS Trustworthiness
The QualiPSo Project

### Short-term support

<table>
<thead>
<tr>
<th></th>
<th>Values</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bugs number available</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>15</td>
<td>47%</td>
</tr>
<tr>
<td>No</td>
<td>17</td>
<td>53%</td>
</tr>
<tr>
<td><strong>Professional services</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>23</td>
<td>74%</td>
</tr>
<tr>
<td>No</td>
<td>9</td>
<td>26%</td>
</tr>
<tr>
<td><strong>Bug tracking</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>25</td>
<td>78%</td>
</tr>
<tr>
<td>No</td>
<td>7</td>
<td>22%</td>
</tr>
<tr>
<td><strong>Bug workflow</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>2</td>
<td>6%</td>
</tr>
<tr>
<td>No</td>
<td>30</td>
<td>94%</td>
</tr>
</tbody>
</table>

A GQM-based Measurement Plan

### Product-related factors

- Trustworthiness
  - Usability
  - Reliability
  - Security
  - Fault tolerance
  - Accessibility
  - Accuracy
  - Interoperability
  - Fault tolerance
  - Testability
  - Maintainability
  - Portability
  - Modifiability
  - Customizability
  - Data exchangeability
  - Resource behaviour
  - Time behaviour
  - Location independence
  - Portability
  - Fault tolerance
  - Accessibility
  - Accuracy

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October 14, 2009

www.qualipso.org
A GQM-based Measurement Plan

- Process-related factors
- Trustworthiness
- Customer satisfaction
- Developer quality
- Cost effectiveness

OSS Trustworthiness
The QualiPSo Project

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The Role of Dynamic Evaluation

- Assess the correctness of OSS
- Assess other qualities
- Build benchmarks
- Investigate prerequisites for common test approaches and benchmarks
- Investigate the use of Aspect-Oriented Programming for dynamic measures
- Investigate existing testing techniques for different classes of OSS products and qualities
Testing: A Survey on Quality Related Activities in OSS

**Carried out by Zhao and Elbaum in 2000**

**Goals**
- discover the quality assurance techniques used by open source developers
- determine the factors affecting the quality assurance activities
- understand the perception of open source developers toward quality assurance

- Questionnaire with 15 questions
  - sent by email to developers
- Analysis on 200 responses

Results: Testing

- No testing plans
  - > 80% of respondents (!)
- However, most of the products
  - spend close to 40% of their lifetime on testing
- Just 21% of the products
  - spend < 20% of their lifetime in testing.
Motivations
OSS vs. CSS
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Assessment of dynamic coupling
- CMC Result (classname, number of classes it is coupled to):
  - org.apache.jmeter.JMeter$ListenToTest 3
  - org.apache.jmeter.NewDriver 2
  - org.apache.jmeter.config.Arguments 4
  - org.apache.jmeter.config.ConfigTestElement 1
  - org.apache.jmeter.control.GenericController 3
  - org.apache.jmeter.control.LoopController 3
  - org.apache.jmeter.engine.PreCompiler 6
  - org.apache.jmeter.engine.StandardJMeterEngine 16
  - org.apache.jmeter.engine.StandardJMeterEngine$StopTest 1
  - ...

Tools
Motivations
OSS vs. CSS
QualiPSo
Trustworthiness
Factors
Available Data
Measurement Plan
Testing
Tools
Experimentation
Conclusions

What tools are needed?
- Test tools
- Measurement tools
- Data analysis tools

Are there any existing OSS tools that can be used?

How can they be integrated?
Experimentation

OSS Trustworthiness
The QualiPSo Project

- We are investigating the use of
  - different experimental designs
  - different statistical techniques
  - surveys
  - automated tools for data collection

Expected Results

OSS Trustworthiness
The QualiPSo Project

- Collected data
- on trustworthiness measures
- on trustworthiness factor measures
- Statistically significant associations/correlations
- Customizable product trustworthiness model
The collection of the subjective evaluation of the various aspects of trustworthiness by users was carried out:

- 22 Java projects
- 22 C++ projects

The questionnaire is also on-line.

We collected 100 questionnaires:
- 774 product evaluations
The Product Evaluation Questionnaire

### Motivations
- OSS vs. CSS
- QualiPSo Trustworthiness

### Available Data
- Measurement
- Plan
- Tools
- Experimentation

### Conclusions

## OSS Trustworthiness

The QualiPSo Project

### Quality of the OSS product

<table>
<thead>
<tr>
<th>Java Projects</th>
<th>Critical</th>
<th>Stable</th>
<th>Project</th>
<th>Stability</th>
<th>Portability</th>
<th>Portability</th>
<th>Correctness</th>
<th>Codelikeness</th>
<th>Programming</th>
<th>Documentation</th>
<th>Reliability</th>
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<tbody>
<tr>
<td>How familiar are you with the product?</td>
<td>[\text{Critical}]</td>
<td>[\text{Stable}]</td>
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### Some Initial Results

- Reliability good/no-good counts vs. Coupling between Objects (CBO):
  - Logistic Regression
    - Estimated Reliability = \(\frac{1}{1+e^{(a+b\cdot CBO)}}\)
  - Measured Reliability = \(\frac{\text{RelOK}}{\text{RelOK}+\text{RelKO}}\)
  - RelOK: response > 4

- We started with data on 15 projects

- Outlier removal
  - eclipse was removed from the data set
  - we get a reasonable model
    - without evident outliers
    - with normal residuals
Some Initial Results

**OSS Trustworthiness**

*The QualiPSo Project*

Motivations
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Work to Be Done

**OSS Trustworthiness**

*The QualiPSo Project*

- Analysis of all qualities with all data
  - including trustworthiness
- Correlation analysis among independent variables
- Multivariate analysis
- Analyses need to be redone every time a new data point is added …
  - we need to have the highest number of data points, for statistical reasons

| Coefficients | Estimate | Std. Error | z value | Pr(>|z|) |
|--------------|----------|------------|---------|----------|
| a            | 1.44555  | 0.76331    | 1.894   | 0.0583   |
| b            | -0.08827 | 0.04986    | -1.770  | 0.0769   |

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MetriSec, Lake Buena Vista, FL, USA
October 14, 2009

www.qualipso.org
Open Source Software is certainly a great opportunity, but

- is it open enough?
- what do we know about its quality?
- how can we really trust it?

Lots of challenges (and research opportunities)

- providing better organization to OSS projects
- research on several topics
- tool support

The QualiPSo project is working to provide at least some answers