Professorship of Open Source Software

- Professor of Computer Science
  - For software engineering and open source software
  - At the computer science department of the engineering faculty

- Previously held research positions at ...
  - SAP Labs (Silicon Valley) leading the open source research group
  - UBS (Swiss Bank, Zurich) leading the software engineering group

- Previously worked in development at ...
  - Skyva Inc. (supply chain software, Boston) as software architect
  - Bayave GmbH (on-demand business software, Berlin) as CTO

- Ph.D. from ETH Zurich, M.B.A. from Stanford GSB
Software is eating the world

WSJ, 2011-08-20
The Impact of Software / Digitization

- Software is a core component of digitization
  - Software radically changes existing businesses and business models
  - Software creates wholly new businesses and business models

- Software radically improves innovation speed
  - Deployment (when new program code delivers economic value) can be nearly instantaneous
  - Existing products are changed to take advantage of software innovation speed
<table>
<thead>
<tr>
<th>Rank</th>
<th>2019, first quarter</th>
<th>2018, first quarter</th>
<th>2017, first quarter</th>
<th>2016, first quarter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Microsoft 904,860</td>
<td>Apple Inc. 851,317</td>
<td>Apple Inc. 753,718</td>
<td>Apple Inc. 607,465</td>
</tr>
<tr>
<td>2</td>
<td>Apple Inc. 895,670</td>
<td>Alphabet Inc. 715,404</td>
<td>Alphabet Inc. 573,570</td>
<td>Alphabet Inc. 535,660</td>
</tr>
<tr>
<td>3</td>
<td>Amazon.com 874,710</td>
<td>Microsoft 702,760</td>
<td>Microsoft 508,935</td>
<td>Microsoft 439,734</td>
</tr>
<tr>
<td>4</td>
<td>Alphabet Inc. 818,160</td>
<td>Amazon.com 700,672</td>
<td>Amazon.com 423,031</td>
<td>ExxonMobil 350,991</td>
</tr>
<tr>
<td>5</td>
<td>Berkshire Hathaway 493,750</td>
<td>Tencent 507,990</td>
<td>Berkshire Hathaway 410,880</td>
<td>Berkshire Hathaway 349,740</td>
</tr>
<tr>
<td>6</td>
<td>Facebook 475,730</td>
<td>Berkshire Hathaway 492,019</td>
<td>ExxonMobil 339,897</td>
<td>Johnson &amp; Johnson 300,604</td>
</tr>
<tr>
<td>7</td>
<td>Alibaba Group 472,940</td>
<td>Alibaba Group 470,930</td>
<td>Johnson &amp; Johnson 337,947</td>
<td>General Electric 295,546</td>
</tr>
<tr>
<td>8</td>
<td>Tencent 440,980</td>
<td>Facebook 464,189</td>
<td>Facebook 334,552</td>
<td>Amazon.com 281,888</td>
</tr>
<tr>
<td>9</td>
<td>Johnson &amp; Johnson 372,230</td>
<td>JPMorgan Chase 377,410</td>
<td>JPMorgan Chase 313,761</td>
<td>Facebook 259,192</td>
</tr>
<tr>
<td>10</td>
<td>Visa 353,710</td>
<td>Johnson &amp; Johnson 343,780</td>
<td>Wells Fargo 278,516</td>
<td>Wells Fargo 246,035</td>
</tr>
</tbody>
</table>

High Profits in the Software Industry Through Vendor Lock-in

- Definition of vendor lock-in
  - The degree of switching costs to an alternative solution
  - Infinite, if there is no alternative solution (monopolist)

- Consequences for customers
  - High license / subscription fees
  - Innovation blockage
  - Operational risk

- Many forms of lock-in
  - Microsoft was the poster child for software vendor lock-in
Open Source Software

- Open source software is software that (by way of a license)
  - Gives users the rights, free-of-charge, to
    - Use the software
    - Modify it for their own use
    - Pass on the modified version
- Open source is also a new model of collaboration in software development
Why Software Vendors Develop Open Source Software 1 / 2 [1]

Without open source

License fee for operating system

License fee for business application

Cost of open source operating system

With open source

Potential added revenues

License fee for business application

$\text{Cost of open source operating system}$

Money spent on solution


Open Source Software and Public Policy
© 2019 Dirk Riehle; some rights reserved
Why Software Vendors Develop Open Source Software 2 / 2
How to Develop Open Source Software

• Jointly and collaboratively
  • Because for any single person or vendor it would be too risky, too expensive
  • But sometimes a strong vendor can go it alone (for other reasons)

• Under the rules of a foundation
  • Because without defined equal and fair playing field, vendors would not come
  • Also: Creates legal and personnel safety, removes unnecessary hurdles
Primary Complement to Open Source Software

- **Service and support** for the open source software
  - For example, IBM Global Services
  - *Any local consulting firm*, really

- Service and support has low barriers to market entry
  - Knowledge lock-in is possible, but much less severe
  - Usually not venture capital funded

- Open source and local services → part of digital sovereignty
Other Complements to Open Source Software

- Exclusion-rights-based complements
  - Closed (proprietary) software
    - Almost all software vendors
  - Generic computing resources for cheaper execution
    - For example, Amazon Web Services
  - Specialized hardware for superior execution
    - For example, Google’s Tensorflow Processing Units
  - Data for superior models / decision making
    - For example, Facebook Advertising

- Vendor lock-in all over again
  - As indicated by venture capital funding
If You Want to Help Your Economy

Create and support openness, where your economy is lagging (compared with the competition)
innovation frontier

How to Support Open Collaboration

- Educate companies
  - Companies often don’t understand the need for and the processes of open collaboration

- **Support foundations**
  - Define a fair and equal playing field and remove bureaucratic and financial hurdles

- Educate the workforce
  - Open collaboration processes are different from traditional work
A Tale of Two User-led Open Source Foundations

Energy

Automotive
## Sample of Current User-led Open Source Foundations

<table>
<thead>
<tr>
<th>Name</th>
<th>Domain</th>
<th>Name</th>
<th>Domain</th>
<th>Name</th>
<th>Domain</th>
</tr>
</thead>
<tbody>
<tr>
<td>3MF</td>
<td>3D printing format</td>
<td>Karuta</td>
<td>Education</td>
<td>openMIS</td>
<td>Health and Insurance</td>
</tr>
<tr>
<td>Apereo OAE</td>
<td>Higher Education</td>
<td>KOHA</td>
<td>Library</td>
<td>OpenJustitia</td>
<td>Law</td>
</tr>
<tr>
<td>Arches</td>
<td>Cultural Heritage</td>
<td>Kuali Core</td>
<td>Higher Education</td>
<td>openKONSEQUENZ</td>
<td>Energy</td>
</tr>
<tr>
<td>Automotive Grade Linux</td>
<td>Automotive</td>
<td>Kuali Financials</td>
<td>Higher Education</td>
<td>OpenLMIS</td>
<td></td>
</tr>
<tr>
<td>Bahmni</td>
<td>Healthcare</td>
<td>Kuali Research</td>
<td>Higher Education</td>
<td>openMAMA</td>
<td>Finance</td>
</tr>
<tr>
<td>Bedework</td>
<td>Neutral</td>
<td>Kuali Student</td>
<td>Higher Education</td>
<td>OpenMDM</td>
<td>Automotive</td>
</tr>
<tr>
<td>BioJava</td>
<td>Bioinformatics</td>
<td>Laboratory Information System/O-Healthcare and Biomedical</td>
<td>OpenMRS</td>
<td>Healthcare</td>
<td></td>
</tr>
<tr>
<td>BioPerl</td>
<td>Bioinformatics</td>
<td>LF Energy</td>
<td>Energy</td>
<td>openPASS</td>
<td>Automotive</td>
</tr>
<tr>
<td>BioPython</td>
<td>Bioinformatics</td>
<td>LocationTech</td>
<td>Geospatial technologies</td>
<td>openSDS</td>
<td></td>
</tr>
<tr>
<td>Canvas (LMS)</td>
<td>Higher Education</td>
<td>Mifos</td>
<td>Microfinance</td>
<td>OpenVDB</td>
<td>Content Creation</td>
</tr>
<tr>
<td>Central Authentication Service (C/Neutral)</td>
<td>O3-DPACS</td>
<td>Healthcare</td>
<td>OSADL</td>
<td>Machine, Machine Tool, Automatic</td>
<td></td>
</tr>
<tr>
<td>Civil Infrastructure Platform</td>
<td>Infrastructure</td>
<td>Open Container Initiative</td>
<td>Technology</td>
<td>PillarOne</td>
<td>Risk Management</td>
</tr>
<tr>
<td>CloudNativeComputing/Prometheus</td>
<td>Open EQUELLA</td>
<td>Neutral</td>
<td>Polarsys/Capella</td>
<td>Systems and Software Engineering</td>
<td></td>
</tr>
<tr>
<td>DHIS2</td>
<td>Healthcare</td>
<td>Open Library Environment</td>
<td>Higher Education</td>
<td>Polarsys/Papyrus IC</td>
<td>Systems and Software Engineering</td>
</tr>
<tr>
<td>Digital Square / DigitalSQR</td>
<td>Healthcare</td>
<td>Open Travel Initiative</td>
<td>Tourism</td>
<td>popHealth</td>
<td>Healthcare</td>
</tr>
<tr>
<td>Eclipse IoT</td>
<td>OpenAirInterface</td>
<td>Software Engineering</td>
<td>RailML</td>
<td>ReqIF Implementor Forum (ReqIF IF)</td>
<td></td>
</tr>
<tr>
<td>ELMS Learning Network (ELMSLN)</td>
<td>Higher Education</td>
<td>openBMC</td>
<td>ReqIF Implementor Forum (ReqIF IF)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evergreen</td>
<td>Library</td>
<td>Opencaast</td>
<td>Higher Education</td>
<td>Sakai</td>
<td>Higher Education</td>
</tr>
<tr>
<td>Finos</td>
<td>Finance</td>
<td>openCourseWare</td>
<td>Education</td>
<td>Thalamus</td>
<td>Healthcare</td>
</tr>
<tr>
<td>Genivi Development Platform (GD)</td>
<td>Automotive</td>
<td>OpenELIS/Global</td>
<td>Health informatics</td>
<td>Unitime</td>
<td>Higher Education</td>
</tr>
<tr>
<td>GNU Health embedded</td>
<td>Healthcare</td>
<td>OpenELIS/US</td>
<td>Health informatics</td>
<td>uPortal</td>
<td>Higher Education</td>
</tr>
<tr>
<td>Hospital Management Information</td>
<td>Healthcare</td>
<td>openETCS</td>
<td>Railway</td>
<td>vistA</td>
<td>Healthcare</td>
</tr>
<tr>
<td>HospitalRun</td>
<td>Health</td>
<td>openGIS</td>
<td>Geographic Information Systems</td>
<td>X-road</td>
<td>e-Government</td>
</tr>
<tr>
<td>iHRIS (Open Source Human Reso Healthcare)</td>
<td></td>
<td>OpenHIE</td>
<td></td>
<td>Xerte</td>
<td>Education</td>
</tr>
</tbody>
</table>
Open Collaboration Status Going into 2020

- Open collaboration for and by the tech industry
  - Mostly understood, sufficiently financed

- Open collaboration for the other industries
  - Open source software [1]
    - Some increasing understanding
  - Open hardware
    - Lagging to software
  - Open data
    - Barely on the radar screen

- The less technical an industry, the more help it needs

If unhappy, go open wherever you want to be sovereign
Thank you! Questions?

dirk.riehle@fau.de – http://osr.cs.fau.de

dirk@riehle.org – http://dirkriehle.com – @dirkriehle
License

- Original version
  - © 2019 Dirk Riehle, some rights reserved
  - Licensed under Creative Commons Attribution 4.0 International License