OPEN SOURCE HARDWARE AT CERN

EVA GOUSIOU | 30 NOV 2022
I. CONTEXT
A COMPLEX MACHINE
A COMPLEX MACHINE

LHC 27 km
PS 0.7 km
SPS 7 km
PSB 0.02 km
PS
OUR MISSION

Carriers

Mezzanines

White Rabbit

★ Dozens of designs
★ Modular & Generic
★ Use of standards
★ Industry Collabs
★ 10y operation
OUR MISSION

... the results of its experimental and theoretical work shall be published or otherwise made generally available.

CERN Convention, Paris, 1st July, 1953
OUR MISSION

- Open Data
- Open Access
- Free Open Source Software
- Open Hardware
II. OPEN HARDWARE AT CERN
WHAT - WHY - HOW

👍 Study
👍 Modify
👍 Distribute
👍 Make & Sell

❤️ No Vendor Lock-in
❤️ More Contributors
❤️ Higher Quality
❤️ Our Mission

# Inspired by SW
1950
Fortran, COBOL
Punchcards

1960
OOP, Classes, Libraries
Compilers

1970
vi, emacs

1980
C, C++

1990
MIT, GPL license

2000
Eclipse, SVN

2005
GIT

2016
GITHUB
> 35M repos

BRIEF HISTORY OF THE SW MILESTONES

A. Wozniak OHS 2020
FOLLOWING THE FOSS PRINCIPLES

1 | Host (like github)
2 | License (like gpl)
3 | Tools (like gcc, eclipse)
FOLLOWING THE FOSS PRINCIPLES

1  |  Host  (like github)
2  |  License (like gpl)
3  |  Tools  (like gcc, eclipse)
Hardware, Firmware, Software

Design choices

Document everything

Issues tracking and detected bugs

Mailing list discussions
Produced Units > 1000
Users outside CERN > 100
Spinoffs > 9
### Commercial and Open

<table>
<thead>
<tr>
<th>Open</th>
<th>Proprietary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Commercial</strong></td>
<td><strong>Non-commercial</strong></td>
</tr>
<tr>
<td><strong>Winning combination</strong>&lt;br&gt;<strong>Best of both worlds</strong></td>
<td>Whole support burden falls on developers. Not scalable.</td>
</tr>
<tr>
<td>Vendor lock-in.</td>
<td>Dedicated, non-reusable projects</td>
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</tbody>
</table>
COMMERCIAL AND OPEN

Fig1. - Problems encountered in open source

Source: opensourcesurvey.org

- Incomplete or confusing documentation
- Unresponsiveness
- Dismissive responses
- Conflict
- Unexplained rejection
- Unwelcoming language or content

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COMMERCIAL AND OPEN

Fig5. - What open source users value in software

Source: opensourcesurvey.org
FOLLOWING THE FOSS PRINCIPLES

1 | Host \[\rightarrow\] ohw.org
2 | License \((like\ gpl)\)
3 | Tools \((like\ gcc,\ eclipse)\)
2 | CERN OPEN HARDWARE LICENCE V2

https://ohwr.org/cernohl

★ CERN-OHL-S: Strongly-reciprocal
★ CERN-OHL-W: Weakly-reciprocal
★ CERN-OHL-P: Permissive
FOLLOWING THE FOSS PRINCIPLES

1 | Host → ohwr.org
2 | License → OHL
3 | Tools *(like gcc, eclipse)*
3 | TOOLS

I. Hardware
3 | TOOLS

II. Gateware, Firmware

★ Simulators: GHDL
★ Dev Flow: HDLmake | Cheby
3 | TOOLS

The Future

★ Libraries (circuits, sub-assemblies) for HW
★ Version Control for HW
★ Debug at the module level
★ Integrated environment with all tools in one place
★ Mixed Language Simulator
III. OPEN HARDWARE – WHERE WE ARE
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A. Wozniak OHS 2020
IV. FINAL REMARKS
YOUR CONTRIBUTION

★ ohwr.org
★ kicad.org
★ zenodo.org
BackUp
OHWR.ORG: A SUCCESS STORY

When every ns counts

★ CERN needs
★ Based on Open standards
★ Institutes & Companies
★ High Quality product
★ Open & Available in industry
★ IEEE standard-extension