

Open Hardware at CERN

Javier Serrano

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Quick disclaimer

CERN is big. Most of what I will say is based on my particular experience working with people, mostly in the Accelerators and Technology Sector, and open-sourcing software, firmware, gateware and hardware over the last 15 years.

Outline

- 1 CERN and Open Source
- 2 Open Hardware (and Gateware)
- 3 Open Source and Knowledge Transfer

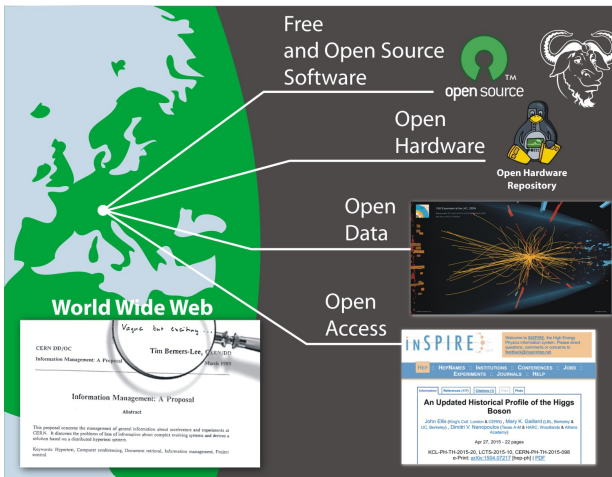
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Dissemination



How to interpret one's dissemination mandate in the 21st century



This and other figures courtesy of Tomasz Włostowski

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Challenges we saw in Open Hardware in the beginning of our journey

Curated repositories of **high-quality designs** with version control and forums

We created ohwr.org. Nowadays, lots of great options.

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Discussions with commercial companies on **business models**

Mostly based on hybrid (open/proprietary) catalogues. Golden rule: in public/private partnerships no actor should be asked to do something “unnatural” to them. Corollary: we don’t tell companies how they should be doing business.

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Free and Open Source Software tools to design hardware and easily share those designs

We contributed greatly to KiCad development. We were less successful with HDL simulators.

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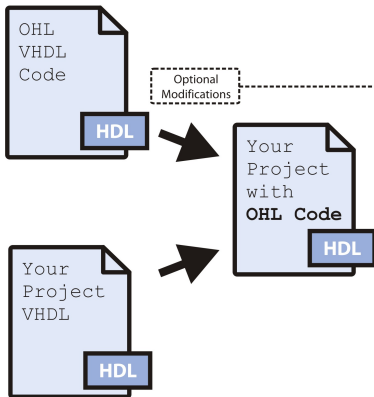
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A sound legal basis for sharing in the form of a good set of **Open Hardware Licences**

CERN OHL v2 (<https://cern.ch/cernohl>) comes in three variants: permissive, weakly-reciprocal and strongly-reciprocal. It works for PCBs and HDL.

CERN OHL v2 for HDL designs

Source Files



OHL Variants

OHL-S
Strongly Reciprocal

All code under OHL-S

OHL-W
Weakly Reciprocal

OHL-W Code
remains under OHL-W
(including modifications)

No obligation to
provide any
source code

OHL-P
Permissive
Use any license you like

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Open Source and Knowledge Transfer

KT's mission at CERN is to maximise impact

- Open source may not be optimal in some cases (e.g. when private investor is needed and they insist in keeping technology proprietary)
- Most apparent in hardware projects, less so in software and gateware

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Revenue generation also part of the picture

- One mode of operation consists in reinvesting benefits to pursue further KT work
- Traditionally, monetising open source has been seen as harder

Two ways forward

Operate outside the money circuit

- We got full support for this at CERN!
- May result in a disconnect from KT for some projects/groups though

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Explore ways of bringing funds to a project

- Foundations, consortia, collaborations. . .
- Could help with other issues, e.g. sustainability
- We are exploring this in White Rabbit now. See <https://white-rabbit.tech>

Open and commercially available off-the-shelf

WR Switch

Seven Sol, Spain
Creotech, Poland



OPNT, Netherlands
SyncTechnology,
China

Simple VME FMC carrier (SVEC)

Janz Tec AG,
Germany



Simple PCIe FMC carrier (SPEC)

Creotech, Poland
INCA, Netherlands
Seven Solutions, Spain
ISD S.A., Greece

Compact Universal Timing Endpoint (Cute-WR-DP)

SyncTech, China



Digitizers

Struck, Germany
SP Devices, Sweden



GPS Disciplined Oscillator

Seven Solutions, Spain

ZEN TP-32 BNC

Seven Solutions, Spain



PXI module

Sundance,
UK



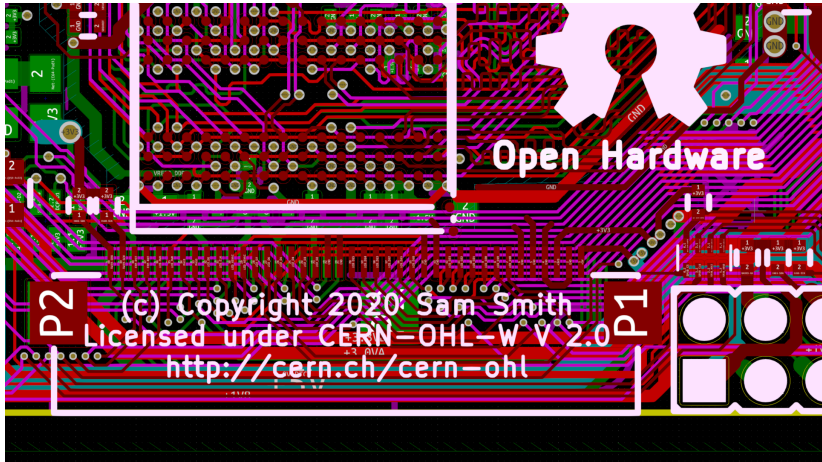
Companies selling White Rabbit and their products:

www.ohwr.org/projects/white-rabbit/wiki/wrcompanies

NOTE: Not all WR equipment is open source

Backup Slides

The importance of FOSS tools for hardware design



Software licensing: our starting point

Mostly copyright licences

- Very uniform legal landscape worldwide
- Modern licences also deal with patents

Three licensing regimes

- Permissive (BSD, MIT, Apache v2)
- Weakly reciprocal (MPL v2, LGPL v3)
- Strongly reciprocal (GPL v3, AGPL v3)

Challenges in hardware licensing

Rights for hardware

Copyright does not generally apply to physical objects

Patents

Much more prevalent in hardware than in software

Reciprocity

What should a reciprocal licence do for a hardware design?
What is the scope of reciprocity?

The hardware design ecosystem

Dominated by proprietary tools, parts of which sometimes go into the design itself

The CERN Open Hardware Licence v2

- Based on rights mainly applying to the design sources (e.g. circuit schematics or CAD drawings)
- Specifies conditions for:
 - Copying designs
 - Modifying designs
 - Distributing modified or unmodified designs
 - Making hardware out of those designs
 - Distributing that hardware
- Drafted by Myriam Ayass, Andrew Katz and Javier Serrano
- Comes in three variants:
 - CERN-OHL-P-2.0 (permissive)
 - CERN-OHL-W-2.0 (weakly reciprocal)
 - CERN-OHL-S-2.0 (strongly reciprocal)

Challenges in hardware licensing

How CERN OHL v2 deals with them

Rights for hardware

CERN OHL v2 makes no assumption about rights

Patents

Two-way patent licensing clauses

Reciprocity

Have URL travel with object and use concepts of Product and Available Component to establish limits of reciprocal obligations

The hardware design ecosystem

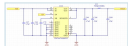
Components which are shipped with design tools qualify as Available Components

CERN OHL v2 for PCB designs

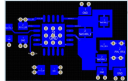
Source Files

OHL-licensed design

Schematics



PCB layout

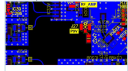


Your project

Schematics



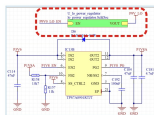
PCB layout



Optional
Modifications

Your project with OHL parts

Schematics



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No obligation to
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source code