

Open Source Hardware for Science and Beyond

Case Study: The White Rabbit Project at CERN

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Open Science Monitor Webinar
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Important note before we begin

Anybody with an interest in Open Source Hardware for Science should also check the excellent work of the GOSH community at <http://openhardware.science/>

Democratisation



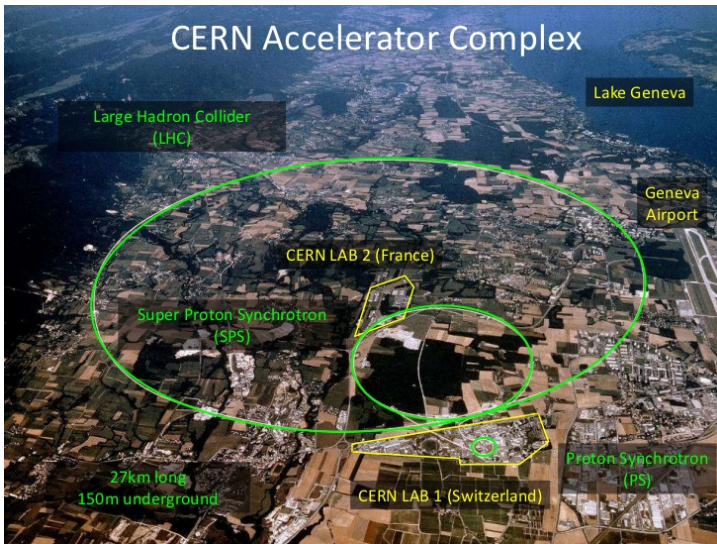
Outline

- 1 Introduction to CERN
- 2 White Rabbit
- 3 Open Source Hardware
- 4 Food for thought and debate

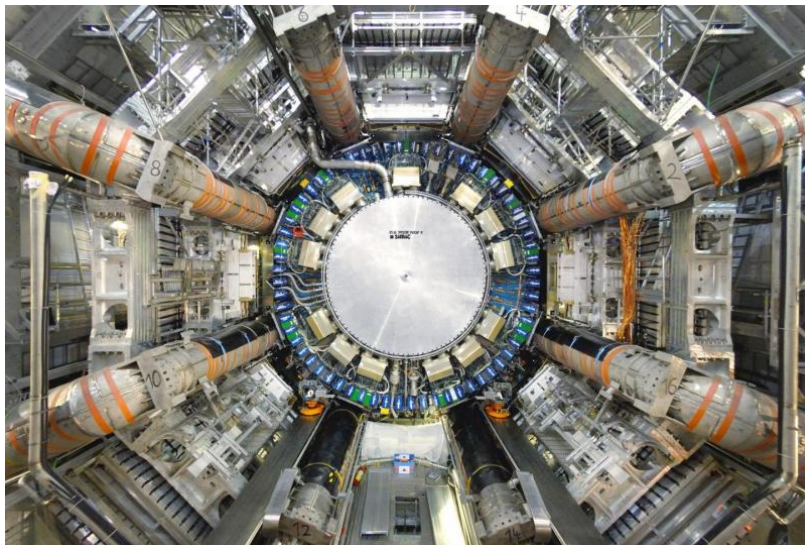
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Accelerators



Detectors



Dissemination



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

World Wide Web

Free and Open Source Software

Open Hardware

Open Data

Open Access

open source

Open Hardware Repository

INSPIRE

Information Management: A Proposal

Tim Berners-Lee, CERN, DD

March 1989

An Updated Historical Profile of the Higgs Boson

John Ellis (Imperial Coll London & CERN), Mary K. Gaillard (J.R. Berkeley & UC Berkeley), Dmitry V. Gribitsyn (CERN & I.H.E.P., Swarthmore & Kansas, Australia)

Apr 27, 2015 - 32 pages

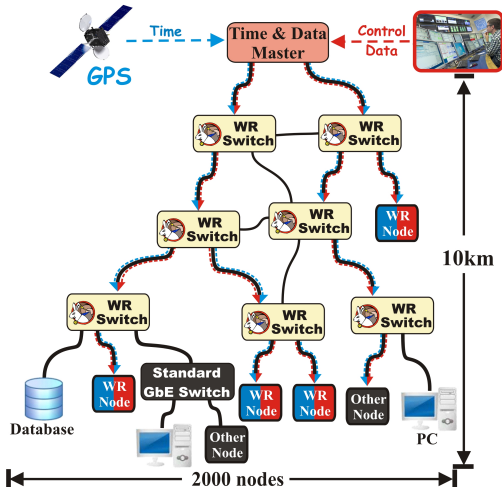
HL-LHC-TH-2015-08, LCTP-2015-10, CERN-PH-TH-2015-088
e-Print arXiv:1504.02217 [hep-ph] | PDF

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White Rabbit: an *extension* of Ethernet

- Standard Ethernet network
- Ethernet features (VLAN) & protocols (SNMP)
- Sub-ns synchronisation
- Guaranteed (by design) upper bound in frame latency

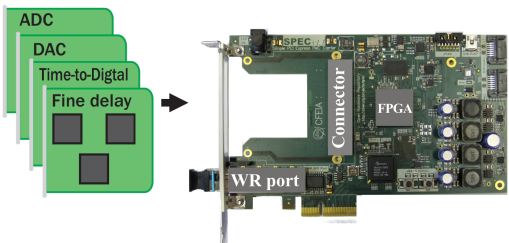


White Rabbit Switch



- Central element of WR network
- 18 port gigabit Ethernet switch with WR features
- Optical transceivers: single-mode fibre, originally 10 km range
- Fully open design, commercially available

WR Node: SPEC board



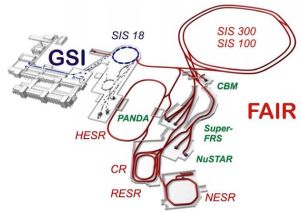
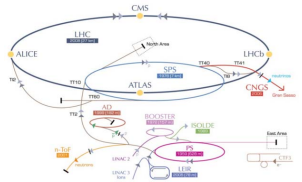
FMC-based Hardware Kit

- All carrier cards are equipped with a White Rabbit port.
- Mezzanines can use the accurate clock signal and “TAI” (synchronous sampling clock, trigger time tag, . . .).

White Rabbit application examples

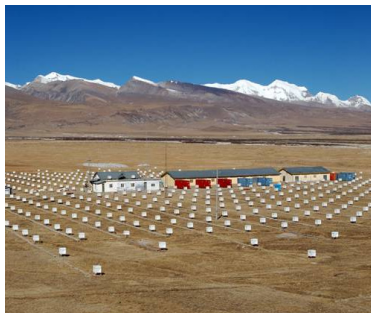
- CERN and GSI

CERN's accelerator complex



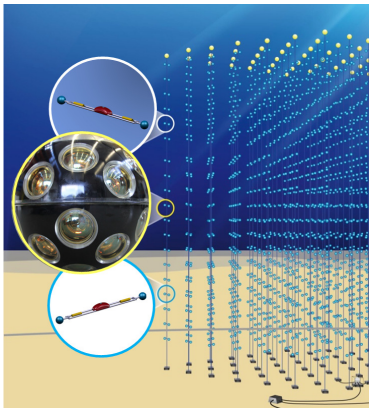
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- CERN and GSI
- The Large High Altitude Air Shower Observatory



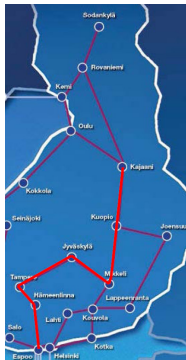
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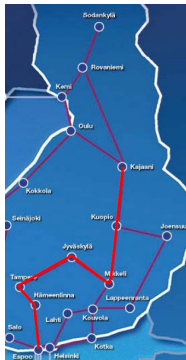


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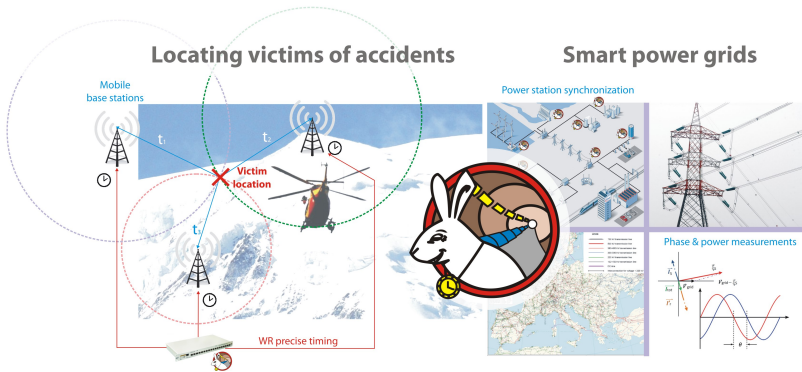
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More WR collaborators/users:

<http://www.ohwr.org/projects/white-rabbit/wiki/WRUsers>



Open source and the unexpected



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OSHW definition

Check out <http://www.oshwa.org/definition/>

- Inspired by the Open Source definition for software
- Focuses on ensuring freedom to study, modify, distribute, make and sell designs or hardware based on those designs

CERN Open Hardware License – ohwr.org/cernohl

Provides a solid legal basis

- Developed in collaboration with Knowledge Transfer Group at CERN
- Better suited than non-HW licenses (GNU GPL, Creative Commons. . .)
- Defines conditions for using and modifying licensed material

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We're working on version 2, stay tuned!

Business models

Dispelling the commercial vs open myth

	Commercial	Non-commercial
Open	Winning combination. Best of both worlds.	Whole support burden falls on developers. Not scalable.
Proprietary	Vendor lock-in.	Dedicated non-reusable projects.

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Public institutions

They serve the interests of a whole society

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Can be “tractor” institutions

- To help take projects to a mature state where they can be sustained commercially.
- Liaising with other public institutions to reach critical mass.
- Also with their procurement hat.

Issues with “coopetition”

Research groups sometimes (often?) end up behaving as private companies (but with public money!) because of wrong incentives by funding agencies.

The funding agencies conundrum



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For the WR community

- Open source
- Lively welcoming environment via mailing list and periodic workshops

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For companies

- Growing open source core
- Space in the periphery for proprietary innovation

Things I believe we did right in the White Rabbit project

For tax payers

- Enlarge the scope of our original project
- Use standard technologies and standardise our enhancements under IEEE 1588
- Open source

And, in general, ensuring a coordinating and facilitating role to make sure the whole project runs smoothly.

Thanks!

