When Hackers Rewrite History: the Lost Machine of Pisa

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Hacking the Smaller Machine
(Hackerando la Macchina Ridotta)

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Hacker, the Jargon definition

A person who **enjoys exploring the details of programmable systems and how to stretch their capabilities**, as opposed to most users, who prefer to learn only the minimum necessary.

Computer history, hacker style

- Recover technical documentation
- Study and deeply understand old technologies
- Check with contemporary knowledge
The CEP project

- **Calcolatrice Elettronica Pisana (CEP)**
  - Pisa Electronic Computer, ~ May 1961
  - The known outcome of a project started in 1955
  - By University of Pisa with Olivetti as partner
  - So far considered the first Italian computer

- **Macchina Ridotta (MR)**
  - Smaller Machine, July 1957
  - First computer built by the same project
  - A fully functional machine
  - Used in 1958 for computing services
The “ultimate” CEP, 1961
The MR, 1957
The MR Control Panel
The lost machine

- The MR has been so far underestimated
  - Indeed, often plainly ignored
  - Previous research did not study MR technology
  - Focused mainly on administrative documents
  - Generally adopting a self-referential approach

- Few facts may explain the MR oblivion
  - People changed, memories vanished
  - The MR was dismantled, no physical relics
  - No inauguration ceremony, no media coverage
  - Misleading official plan (no prototype needed)
Rediscovering the MR

- Digging the archives
  - A long treasure hunt started in 2006
  - Incomplete documentation
  - Tech reports, blueprints, admin stuff, notes…
  - All wildly shuffled

- Two versions of the MR
  - First design, July ’56, probably only on paper
  - The actual MR, implemented one year later
  - Lot of rethinking, reworking and learning
  - A truly well thought-out design
The MR fact sheet

- Very first Italian build computer in 1957
  - Third to run, after CRC102A and Ferranti Mk1
  - 1958 Olivetti “Macchina Zero” (in Pisa too)
  - 1959 Olivetti ELEA 9002, Padova Booth APE
  - 1960 First production ELEA 9003s

- MR characteristics
  - 1024 x 18 bits words
  - 4-8 mms variable clock (125-250 KHz)
  - 2 punched tape readers
  - 2 teletypes, keyboard in and paper/tape out
State of the art solutions

- **Parallel architecture**
  - Many early 1950s machine processed word bits sequentially, MR used the parallel solution

- **Ferrite core memory**
  - Wrt. other choices the MR was an early adopter of this soon to be standard solution

- **Microprogrammed control**
  - Adopting a MIT technology, the MR first implemented the idea proposed by EDSAC2
Other relevant features

- Very high raw performance
  - Compared to the Paris IBM 704, the MR had better KIPS (71.4, the 704 had Fortran, however)

- Bootstrap in Direct Memory Access
  - To boot the “MR OS” a memory image is read from punched tape in “DMA mode”

- Hot breakpoints
  - Programmers can set breakpoints which are activated by Control Panel keys
Rebuilding the MR: sims
6 bits full adder, early 1956
- The very first piece of the very first computer :) 
- 1/3 of the MR adder, part of the machine ALU 
- Additions and subtractions in 2’s complement 
- Rebuilt from original blueprints 
- Very close to IBM 701 adder

A fine cooperation
- Computer Museum of Novara
- National Institute for Nuclear Physics – Pisa
Men at works
Teaching at the Museum

- Museums must exhibit alive machines
  - Computer are made to run
  - A half of Computer Science is software
  - Young people has no memories (nor nostalgia)

- Goals
  - Better understanding of how computers work
  - Re-enact the experiences of pioneers
  - Feel the progress of technologies
  - Challenge kids with demanding tasks
A session on the MR57
Binary exercises
And now ...

- A little game to present the MR 57
  - Actually a pseudo RNG
  - Using an algorithm not yet invented in 1957
  - A curious time paradox
  - A sort of tribute to Alan Turing (1912-1954)

- Useful to see
  - How to start a program
  - A simple usage of the control interface
  - The basic operating modes of the MR57
  - An example of the hot breakpoint feature
... the MR Slot Machine!