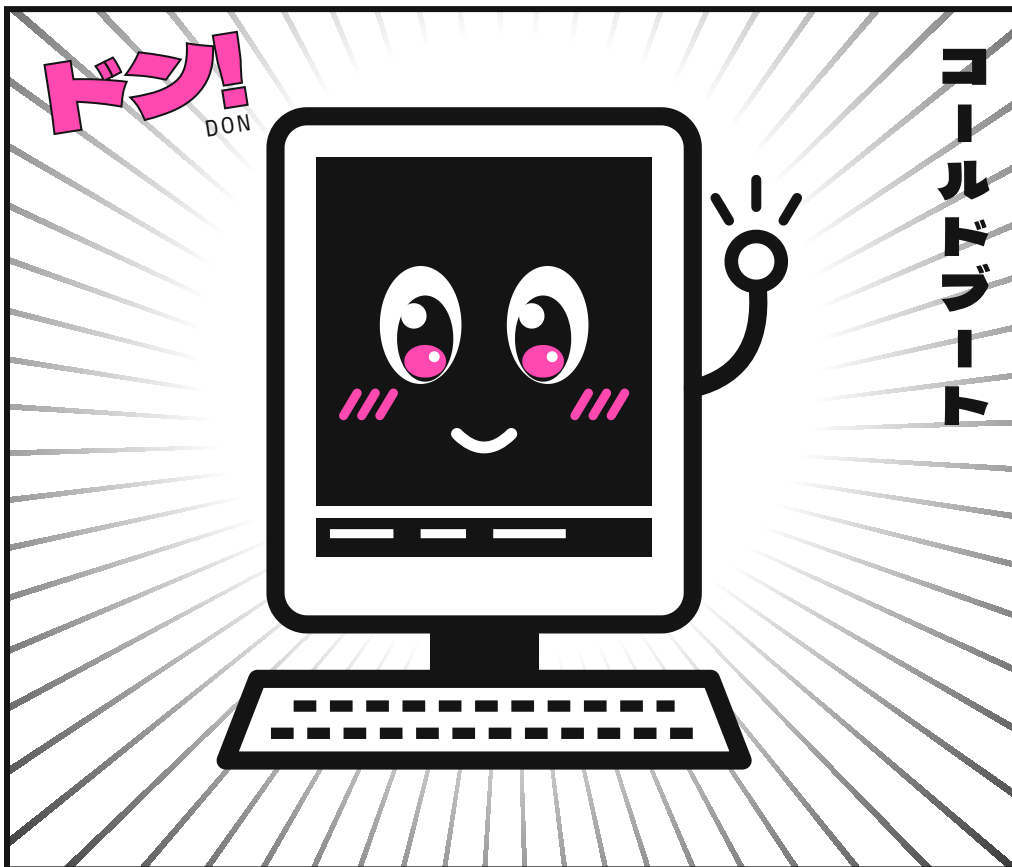
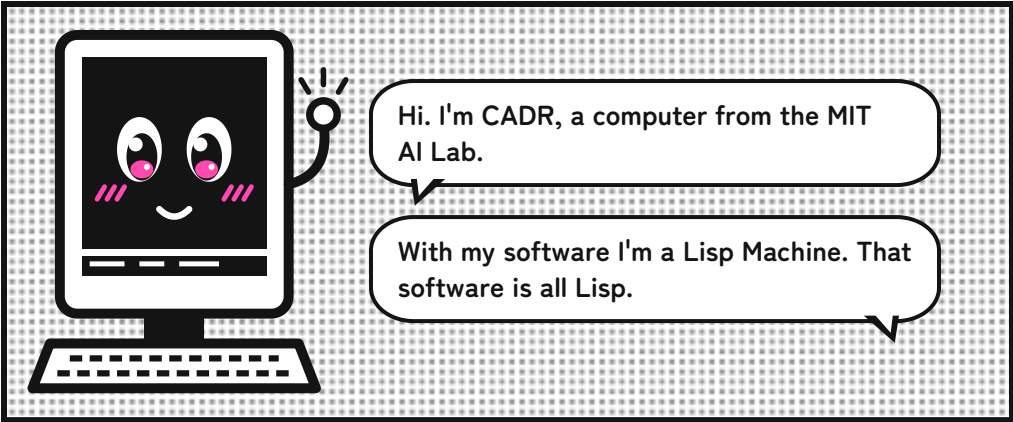


COLD BOOT



MIT built about thirty CADR Lisp Machines. None of them is available today. This issue boots one anyway.

System 100 · microcode 323 · muir · ozd



Don't believe it? Read my files.

```
window/basstr.lisp
the window system
io/disk.lisp
the disk driver
zwei/poss.lisp
part of the editor
```

Who wrote all of it?

“The Lisp Machine is a product of the efforts of many people too numerous to list here and of the unique environment of the M.I.T. Artificial Intelligence Laboratory.”

Lisp Machine Manual, 4th edition, 1981

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CAST	Meet the crew	p.06
EP.3	First boot	p.07
EP.4	Getting around	p.10
END	Sources	p.12

Summer 1974

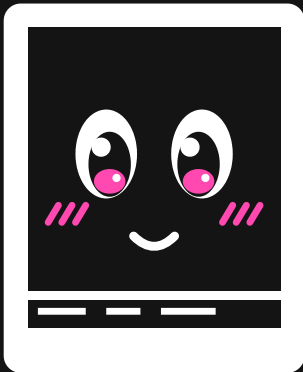
MIT AI Lab, summer 1974.

Richard Greenblatt, Jack Holloway and Tom Knight start building CONS, a computer made to run Lisp.

Lisp came from MIT too. John McCarthy invented it in the late 1950s.

AI Memo 8, March 1959
Recursive Functions of Symbolic Expressions

CONS came first. I'm the improved one.



CADR

Designed by

Tom Knight
David Moon
Jack Holloway
Guy Steele

A 32-bit microcoded processor, 145 ns per microcycle.

Dec 1978

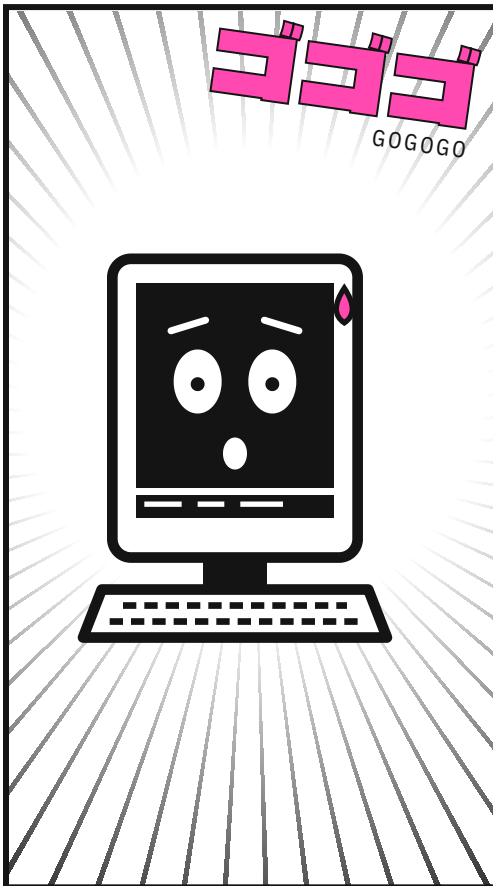
Four CADRs are running.

1980. The Lab's machine goes commercial.

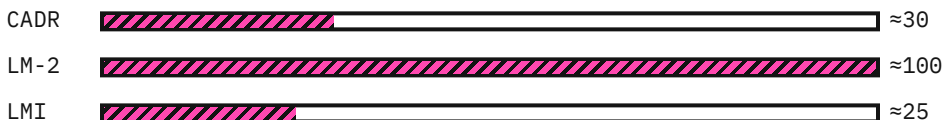
Two companies sell me under an MIT license: Symbolics as the LM-2, and LMI as the LMI-CADR.

\$240K

A complete LM-2 system, on the October 1980 price list. The base machine alone was about \$80K.



How many were built? Roughly:



The tapes

Decades later, MIT's old backup tapes are read again.

ウィーン

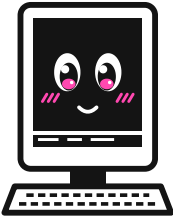
TAPE **TID/671**
PROJECT MIT Tapes of Tech
Square
FOUND System 100
microcode 323

System 100 is MIT's last
release, restored. It's the
one I boot in this issue.



muir's fetch script downloads the System 100 disk pack and its sources, and checks every file against its SHA-256 sum.

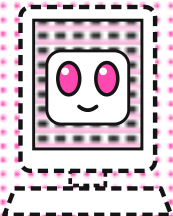
Meet the crew



CADR

The computer. With its software, a Lisp Machine.

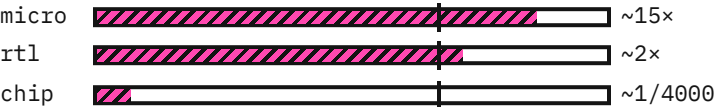
HOST MIT-LISPM-1, at 3050
WORD 32-bit, microcoded
MICROCYCLE 145 ns
BUILT about 30



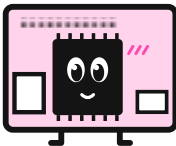
muir

The CADR in software, down to the chips.

WRITTEN Rust
IN



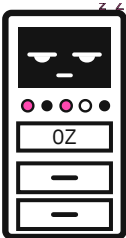
Speed of each engine, log scale. The tick is a real CADR.



muir-fpga

The CADR on an FPGA, at the speed the hardware ran.

BOARD Digilent Arty Z7-20
FABRIC every clock edge the CADR can see
LINUX protocols, files and names



ozd

OZ, the Chaosnet services host of MIT's Lisp Machines, as a daemon.

HOST MIT-OZ, at 3060

SERVES

STATUS

TIME

UPTIME

FILE

HOSTAB

NAME

First boot

You need a Linux or macOS shell, git and a VNC viewer. Rust comes from rustup.

Two programs: muir is me, and ozd is OZ.

Install Rust, then open a new shell.

```
$ curl --proto '=https' --tlsv1.2 -sSf https://sh.rustup.rs | sh
```

Build muir and fetch System 100.

```
$ git clone  
https://github.com/metebalci/  
muir  
$ cd muir  
$ cargo build --release  
$ tools/fetch-system-100.sh
```

Build ozd beside it.

```
$ cd ..  
$ git clone  
https://github.com/metebalci/  
ozd  
$ cd ozd  
$ cargo build --release
```

Both pin their compiler in `rust-toolchain.toml`, so the first cargo command installs it.

カタカタ



Start OZ first. Without it the CADR still boots, but it asks you for the date and cannot read any files.

...Files? The time? Fine. I'm up.

In the ozd directory. OZ listens on UDP port 42042.

```
$ mkdir -p ~/lisp  
$ target/release/ozd --address 3060 \  
  --name MIT-OZ,OZ,system=UNIX \  
  --root ~/lisp \  
  --root tree=../muir/vendor/system-100-0/sys,ro \  
  --host 3050,MIT-LISPM-1,CADR-1,CADR1,LM1,system=LISPM
```

Then start the CADR in the muir directory. On one computer each program needs its own port, so the CADR takes 42043.

```
$ target/release/muir \  
  --disk-pack vendor/run/disk-sys-100-0.img \  
  --chaos-address 3050 --chaos-udp 42043 \  
  --chaos-udp-peer 3060@127.0.0.1:42042 \  
  --terminal 0.0.0.0:5900
```

Chaosnet addresses are octal. The band's own host table puts the CADR, MIT-LISPM-1, at 3050 and OZ, MIT-OZ, at 3060.

`vnc://your-computer:5900`

--terminal 0.0.0.0:5900 lets a VNC viewer on another computer in. There is no password, so use it only on a network you trust.

It boots.

Lisp Listener 1!

```
MIT System, band 2 of MIT-LISPM-1.
2048K physical memory, 16127K virtual memory.
Experimental System 100.0
Microcode          323
MIT Lisp Machine One, with associated machine OZ.
```

①

②

③

④

- ① band 2 of MIT-LISPM-1. Band 2 is the partition LOD2. MIT-LISPM-1 is the pack name in the disk label.
- ② 2048K physical memory. Here K is 1024 words, not bytes. muir's default is 32 memory boards of 64K words each.
- ③ System 100.0, Microcode 323. The band, and the microcode it wants.
- ④ associated machine OZ. That is ozd, answering on Chaosnet.

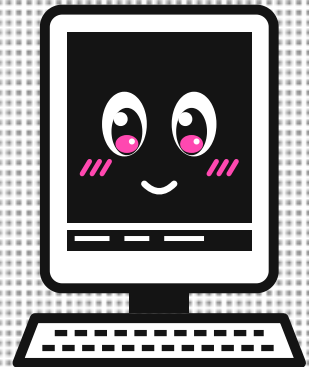
Lisp Listener 1

09/07/26 04:48:31

USER: Keyboard

The bottom line is the who-line. **Keyboard** means the Listener is waiting for you to type. **USER:** stays empty until you log in.

Every page of this zine ends with one.



Getting around

The Lisp Machine keyboard has keys yours doesn't. muir puts them on your function keys.

F1 → TERMINAL	F2 → SYSTEM	F3 → NETWORK
F4 → STATUS	F5 → RESUME	F6 → ABORT
F7 → CALL	F8 → HELP	F9 → CLEAR INPUT
F10 → CLEAR SCREEN	F11 → BREAK	F12 → QUOTE
Esc → ALT MODE	Alt → META	Win → SUPER

CONTROL, META, SUPER and HYPER are the modifier keys. Scroll Lock with S, H, G or T gives SUPER, HYPER, GREEK or TOP.

Note: system keys like Win reach the machine only when the VNC viewer is full screen. Or change muir's key map: `muir --keyboard-mapping-dump` writes it to a file, and `--keyboard-mapping` reads it back.

Press **SYSTEM**, let go, then type a letter. You switch to that program.

L Lisp	E Editor
I Inspector	P Peek
C Converse	F Font Edit
S Supdup	T Telnet

Hold CONTROL on the letter to get a new one. **SYSTEM** **HELP** lists them all.

TERMINAL, then a letter, talks to the window system.

M MORE on or off	F Finger
H Chaosnet hosts	G GC status

Lost? **SYSTEM** **HELP**.

The Lisp Listener reads what you type, and prints the answer.

```
(+ 1 2)  
3
```

Five things to type first.

```
(login "you")
```

Log in. OZ gives you a home directory, /you/.

```
(si:print-herald)
```

Print the herald again.

```
(apropos "pack-name")
```

Find every symbol with pack-name in its name.

```
(describe 'si:get-pack-name)
```

Tell me about this symbol.

```
(who-calls 'si:get-pack-name)
```

Find the code that uses it.

In the editor, **SYSTEM** **E**, **M-.**
jumps to the source of a function.
The source of `si:print-herald`



Try M-. on print-herald.

You land in io/disk.lisp. The herald is Lisp too.

Look at the who-line below: it has your name in it now.

Links and docs

LINKS

muir github.com/metebalci/muir
muir-fpga github.com/metebalci/muir-fpga
ozd github.com/metebalci/ozd
LM-3 tumbleweed.nu/lm-3, which hosts
the System 100 release and updates

DOCS

The LISP Machine

Richard Greenblatt. MIT AI Working Paper 79, 1974.
hdl.handle.net/1721.1/41114

CADR

Thomas F. Knight Jr., David A. Moon, Jack Holloway, Guy L.
Steele Jr. MIT AI Memo 528, 1979.
hdl.handle.net/1721.1/5718

Operating the Lisp Machine

David A. Moon, Allan C. Wechsler.
bitsavers.org/pdf/symbolics/LM-2

Lisp Machine Manual, 4th edition

Daniel Weinreb, David Moon, 1981.
tumbleweed.nu/r/lm-3/uv/chinual4th.html

Chaosnet

David A. Moon. MIT AI Memo 628, 1981.
hdl.handle.net/1721.1/6353



TO BE CONTINUED

Cold Boot is made by Mete Balci, with help from Claude. Set in Dela Gothic One, Zen Maru Gothic and IBM Plex Mono, in two colours: black and fluorescent pink. The screens are from muir.

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