Hatari – a cycle accurate Atari ST emulator

https://hatari.tuxfamily.org/

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FOSDEM Retrocomputing developer’s room
About me

• Grown up with an Atari ST as first computer
• Atari Falcon owner in the mid 1990s
• Moved to Linux after Atari ST era was over
• Maintainer of Hatari from 2001 – 2010 (now still backup admin)
Atari ST – What’s that?
The Atari machines

The original Atari ST:

- 8 Mhz 68000 CPU, 360 KB or 720 KB floppy
- Initially 512 kiB or 1 MiB RAM (later „Mega“ models had up to 4 MiB RAM)
- 3 fixed screen resolutions: mono, 4 colors, 16 colors (out of 512 possible)
- „Simple“ soundchip: Yamaha YM-2149
The Atari machines

- **STE:**
  Like ST, but with sample sound, hardware scrolling, blitter chip, more color grades (4096 instead of 512)

- **TT:**
  32 Mhz 68030 CPU, more screen resolutions, FPU, real SCSI, more RAM, ...

- **Falcon:**
  16 Mhz 68030 CPU, DSP 56k, IDE hard disk, extended „Videl“ video chip ...
History of Hatari

- 2001: Initial version, based on WinSTon and UAE CPU code, SourceForge project
- 2003: v0.30 / v0.40 – first „usable“ versions
- 2005: v0.80 – STE support
- 2007: v0.95 – Initial TT & Falcon support
- 2008: v1.0 – better CPU cycle emulation
History of Hatari

- 2008 / 2009: v1.2 – moved to berlios.de, repository switched to Mercurial
- 2010: v1.4 – Nicolas becomes main admin
- 2012: v1.6 – moved to tuxfamily.org
- 2016: v2.0 – Switch to WinUAE CPU core, use SDL2 by default
- 2019: v2.2 – SCSI emulation, CI testing, ...
How to use it

Get a TOS ROM (firmware first):

- TOS 1.00 - 1.04 for ST mode (or 2.06)
- TOS 1.06 - 2.06 for STE mode
- TOS 3.0x for TT mode
- TOS 4.0x for Falcon mode
How to use it

Get a TOS ROM (firmware first):

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- Open source alternative for any machine:
  EmuTOS – http://emutos.sourceforge.net/
How to use it

- Software on floppy disk images:
  
  *.st, *.msa, *.dim, *.stx, ...

  → hatari -t toofile.rom diskfile.msa
How to use it

• Software on floppy disk images:
  *.st, *.msa, *.dim, *.stx, ...
  → hatari -t tosfile.rom diskfile.msa

• Software on host file system:
  Use the „GEMDOS HD“ emulation
  → hatari -t tosfile.rom -d ~/folder
How to use it
Or press F12 to use the GUI:

Hatari main menu

System  Floppy disks  Joysticks
CPU     Hard disks  Keyboard
ROM     Atari screen  Devices
Memory  Hatari screen  Sound
About   Load config  Save config
◊ No Reset  OK
◊ Reset machine  Quit  Cancel
What’s that fuss about cycle accuracy?
(or: why does it take so much host CPU power to emulate old systems)
Cycles?

- 8 Mhz CPU clock → 8 million cycles per second
- Each instruction takes a different amount:

  MOVE.W #$0700,$00ff8240  # 20 cycles
  LEA.L $00ff8240,A0       # 12 cycles
  MOVE.W #$0700,(A0)       # 12 cycles
  MOVE.W #$0700,D0         #  8 cycles
  MOVEA.L #$00ff8240,A0    # 12 cycles
  MOVE.W D0,(A0)           #  8 cycles
Why cycle accuracy?

At a first glance, the ST is rather simple:

- Only three fixed resolutions:
  - 640 x 400 in monochrom, 71 Hz
  - 640 x 200 with 4 colors, 50 Hz or 60 Hz
  - 320 x 200 with 16 colors, 50 Hz or 60 Hz
- No hardware scrolling
- Rather simple sound chip
Why cycle accuracy?

- Game and demo developers tried to overcome these limits!
- Sample sound possible by quickly changing the volume registers of the sound chip
- Overcome 16 colors by changing the palette while the electron beam runs over the screen
- ... and more graphical tricks ...
Spectrum 512 picture (60 Hz)
... in Hatari v0.90 ...
Hatari v0.80: no 60 Hz support
Without spec512 support
More graphical tricks

- Borders removal (Overscan) by toggling 50 Hz ↔ 60 Hz at certain screen positions
- Plain ST can only „scroll“ by 8 lines vertically (screen address low byte register is missing)
- With overscan tricks in the upper border, the screen can also be moved by 1 line vertically
  → Sync scrolling technique
  → https://www.youtube.com/watch?v=F4WJYyoF1Lk
Thanks for your attention!

Visit

https://hatari.tuxfamily.org/

for more information