



# Atari ST Free Operating Systems

Vincent Rivière

foss-north.se // 2018-04

# About me

Contact: [vincent.riviere@freesbee.fr](mailto:vincent.riviere@freesbee.fr)  
a.k.a. *BlankVector* on some forums



Vincent Rivière

- French guy, 42 years old
- Born in south of France, living in Paris
- Currently working as software developer in University Paris 1 Panthéon-Sorbonne

First owned computer in 1992:



# The Atari ST



# Atari ST: General

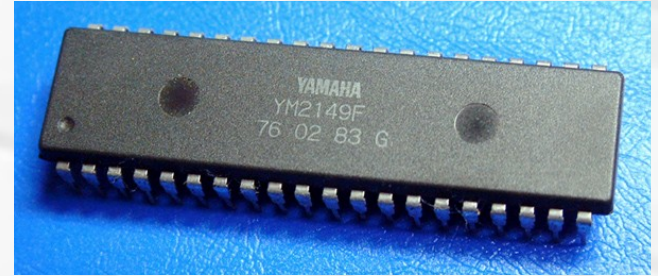


- Available since 1985
- CPU: **Motorola 68000** @ 8 MHz
- RAM: Between 512 KB and 4 MB
- With color monitor or TV:  
320x200 (16 colors), or 640x200 (4 colors)
- With monochrome monitor:  
640x400 (black and white)



# Atari ST: Sound

- Basic YM-2149 soundchip,  
same as AY-3-8910 found  
in Amstrad CPC, ZX Spectrum, Oric.  
3 square wave voices
- **MIDI ports** for synthesizers  
Very popular among musicians



# Atari ST: Storage

- 3"½ floppies, double density  
same 720 KB format as PC (FAT12)



- Additional external hard disk:

- ACSI (Atari specific)
- SCSI (with adapters)



typical capacity from 20 to 100 MB



# Operating System: **TOS** **The O**perating **S**ystem



- Mainly graphical programs with mouse, menus, windows and dialogs
- Also supports full-screen text programs
- Can run a single program at once  
+ desktop accessories

# GEM Desktop 1/3

Low  
resolution  
320x200  
16 colors



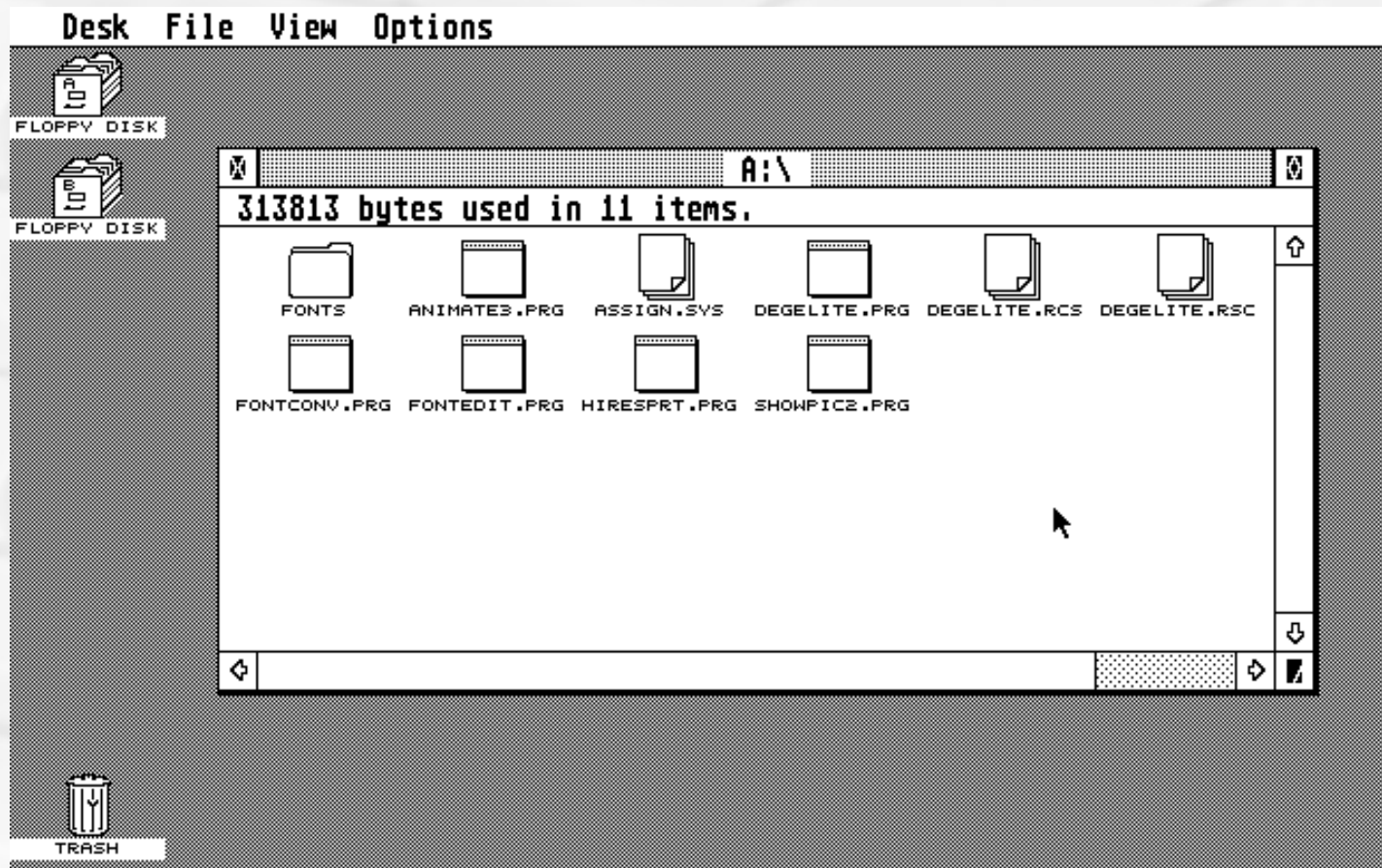
# GEM Desktop 2/3

Medium  
resolution  
**640**x200  
4 colors



# GEM Desktop 3/3

High  
resolution  
640x400  
mono-  
chrome





Some **Atari programs**  
based on my own experience  
between 1992 and 1997



# Dialog-based application

FastCopy  
III

Floppy  
copier

FCOPY\_3.PRГ

» FastCopy III « -- by Martin Backschat (Version 5.2.1990)

Select Option! 3949 KB

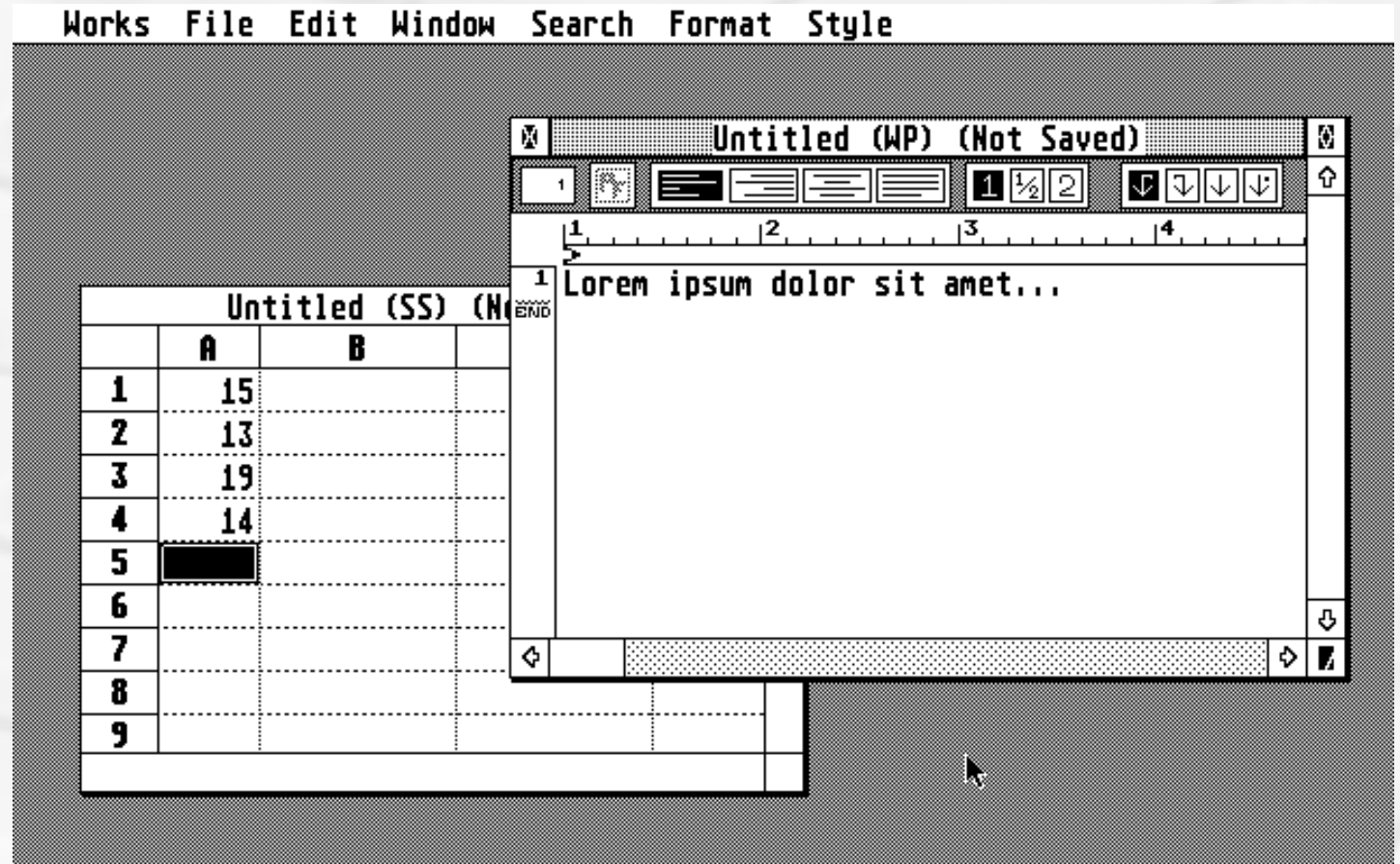
Copy Disk	Scan Disk	Format Disk	Directory	Quit
New Conf	Virus Check	Soft Format	Streamer	Help

Verify Destination <input type="checkbox"/>	Source <span style="background-color: red;">A</span> <span style="background-color: red;">B</span>	Disk Configuration
Fast Format Dest. <input type="checkbox"/>	<span style="background-color: red;">2</span> <span style="background-color: red;">3</span> <span style="background-color: red;">6</span> <span style="background-color: red;">12</span> ms	
Read Disk Config. <input type="checkbox"/>	Dest. <span style="background-color: red;">A</span> <span style="background-color: red;">B</span>	Sides: <span style="background-color: black;">1</span> <span style="background-color: black;">2</span>
Multiple Copy <input type="checkbox"/>	<span style="background-color: red;">2</span> <span style="background-color: red;">3</span> <span style="background-color: red;">6</span> <span style="background-color: red;">12</span> ms	Sectors: <span style="background-color: black;">-</span> <span style="background-color: black;">03</span> <span style="background-color: black;">+</span>
Get Sectors <span style="background-color: black;">all</span> used		Start at Track <span style="background-color: black;">-</span> <span style="background-color: black;">00</span> <span style="background-color: black;">+</span>
		End at Track <span style="background-color: black;">-</span> <span style="background-color: black;">79</span> <span style="background-color: black;">+</span>

# Window-based application

Atari  
Works

Word  
processor,  
spreadsheet,  
database

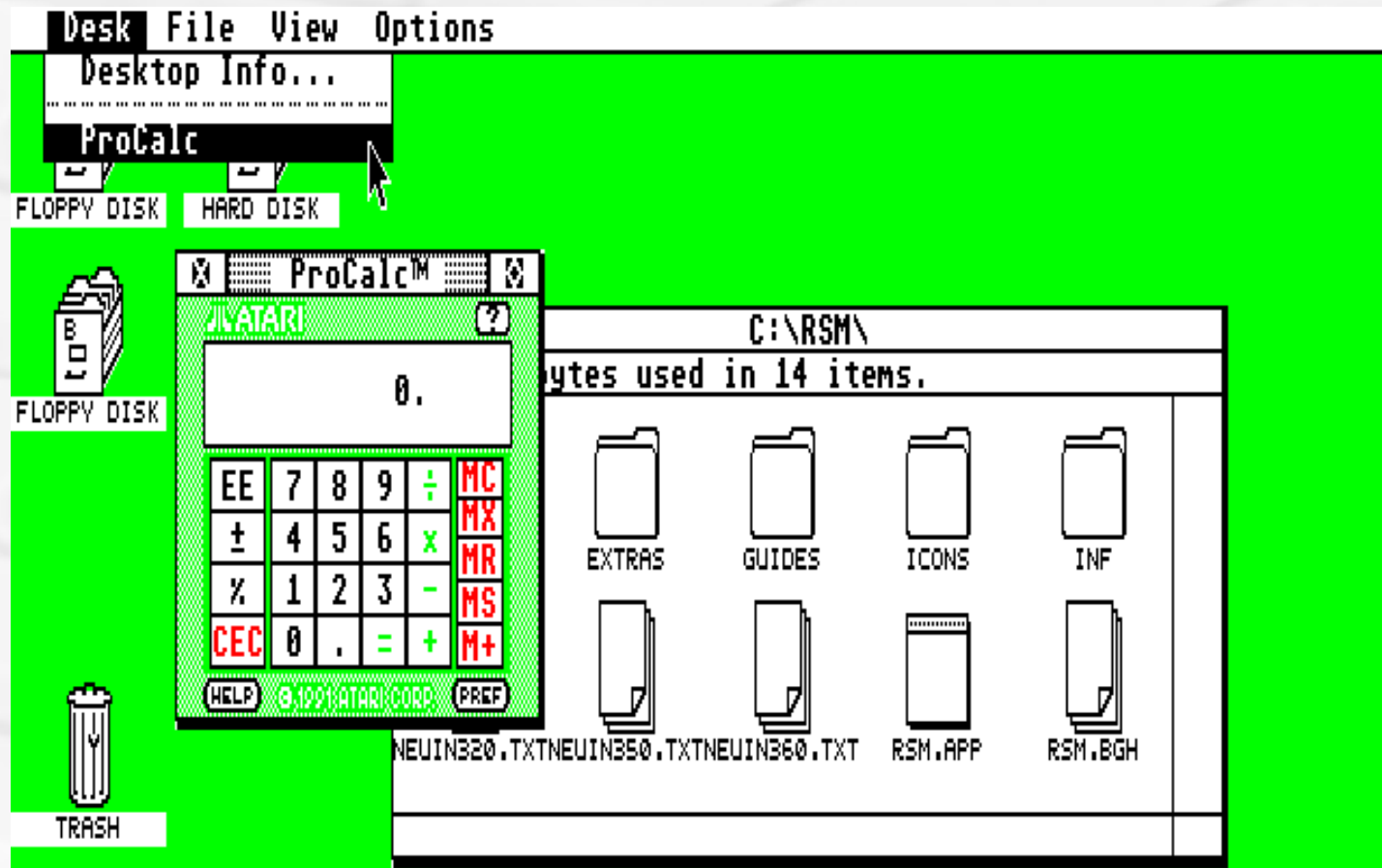


# Desktop accessory

ProCalc

Desktop  
calculator

Limited  
cooperative  
multitasking



# Text Mode application

## LHarc archiver

```
LHarc Version 3.12 junior (Atari)
(c) Yoshizaki, 1988-1989, Grunenberg, Mandel, 1994, Haun, 1996
===== Jul 25 1996 =
Syntax: LHarc [<command>] [{(-|/){<switches>[-|+|0-3]{<options>}}...] <archive>
        [{<Drive>:[\]}|<Base-Directory>\}] [&|&-|~] <Paths/Files> ...}
-----

<Command>
a: Add files to archive                u: Update newer files to archive
f,r: Freshen/Re-construct archive      m: Move files to archive (means 'a -d')
d: Delete files from archive          e,x: Extract files from archive
p: DisPlay files on screen            l,v: List/Verbose list of archive
t: Test integrity of archive          c: Compress files in AFX-format
-----

<Switches> (WARNING: The meaning of the d-switch has been completely changed)
a: Any attribute                      b: Clear 'Changed'-attribute
c: Skip time-comparison               d: Delete files after command
e: Include file-comments              f: Include folders in archive
g: Extract archive in folder          h: Hold screen after finishing
i: Ignore attributes                 j: Exclude empty files
k: Header-level (0-2)                l: Use Larc compatible method
m: No Message at query               n: Set process-indicator
o: Use LHarc 1.13 compatible method p: Distinguish pathnames
q: Suppress all messages (quiet)     r: Recursive expansion of dirs
-- Press key to continue --
```

# Games

## Wings of Death





# Demos!

Cuddly  
Demos



# Atari TOS could be seen as...



- GUI similar to Macintosh
- API similar to MS-DOS...
- ... with very different BIOS
- Fortunately much cleaner and nicer than PC thanks to the 68000 processor.

# TOS internals

GEM

**Desktop:** visible user-interface

**AES:** menus, windows, dialogs

**VDI:** low-level graphics driver and routines

**GEMDOS:** memory, filesystem, processes

**BIOS / XBIOS:** low-level hardware functions

Hardware

# Programming

- Basic: GFA, Omikron...
- Assembly: Devpac...
- C (with hard disk): Pure C...

# Assembly language

Devpac2

GenST2  
editor  
assembler

```
Zz Fichier Recherche Options Prg
C:\DEVPAC2\HELLO.S
Line: 2 Col: 45 Mém:59735
* Simple Hello World

    pea    msg(pc)
    move.w #9,-(sp)      ;Cconws()
    trap   #1            ;Display string
    addq.l #6,sp

    move.w #8,-(sp)      ;Cnecin()
    trap   #1            ;Wait for a key
    addq.l #2,sp

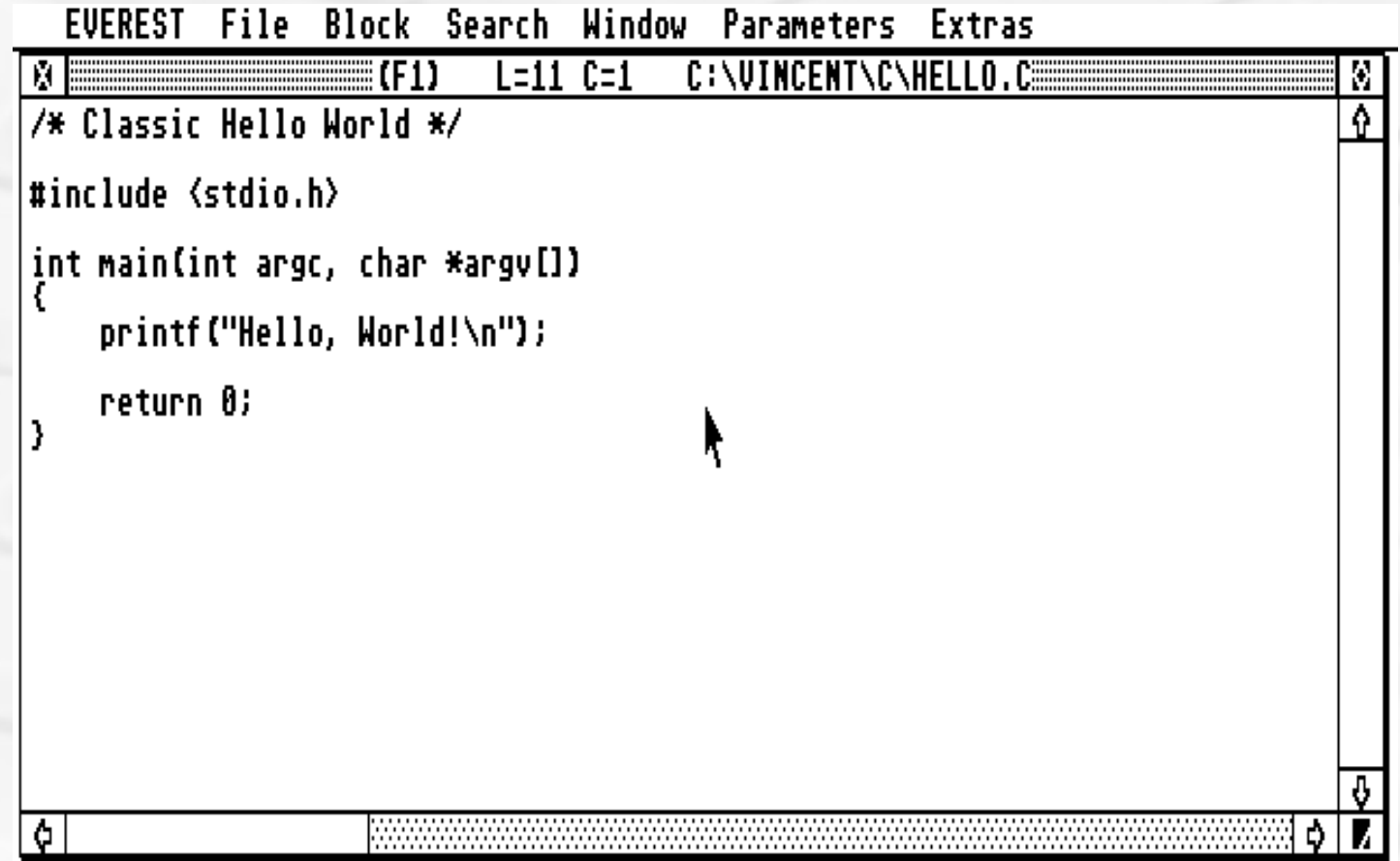
    clr.w  -(sp)         ;Pterm0()
    trap   #1            ;Exit

msg:  dc.b  "Hello, World",13,10,0
```

# C language

Everest

Text  
editor

A screenshot of the Everest text editor window. The title bar reads "EVEREST File Block Search Window Parameters Extras". The menu bar includes "File", "Block", "Search", "Window", "Parameters", and "Extras". The status bar at the top shows "(F1) L=11 C=1 C:\VINCENT\C\HELLO.C". The main text area contains the following C code:

```
/* Classic Hello World */  
#include <stdio.h>  
  
int main(int argc, char *argv[])  
{  
    printf("Hello, World!\n");  
    return 0;  
}
```

A mouse cursor is positioned over the code. The bottom status bar shows a file icon, a dotted pattern, and a save icon.



# Few CLI, but nice ones

TomShell

Command  
line  
interface

```
TomShell v0.200! (90Dec16a) by Tom Clegg  
Copyright (C) 1988-91 Tom Clegg
```

```
Send $20 for a registered copy:  
276 Main Street  
Ottawa, Ontario  
K1S 1C9
```

```
c:\vincent > █
```

# C compilers

C68

Free  
command-  
line  
ANSI C  
compiler

```
c:\vincent\c > dir hello.c
----a  hello.c                134  Apr 10, 2018  20:13:04
134 bytes used in 1 items.
c:\vincent\c > cc68x hello.c -o hello.tos -v
cpp -S -D__TOS__ -D__C68__ -D__MSHORT__ -ansi -T hello.c c:\tmp\hello.i
c68 c:\tmp\hello.i c:\tmp\hello.s
as68 c:\tmp\hello.s c:\tmp\hello.o
rm -f c:\tmp\hello.i
rm -f c:\tmp\hello.s
ld -o hello.tos crt0.o c:\tmp\hello.o c:\usr\lib\libc.a
rm -f c:\tmp\hello.o
c:\vincent\c > dir hello.tos
----a  hello.tos             15336  Apr 10, 2018  20:14:02
15336 bytes used in 1 items.
c:\vincent\c > hello
Hello, World!
c:\vincent\c > █
```

*A few years before...*

**Something unexpected  
appeared on Atari computers.**



# **MiNT: MiNT is Not TOS**

Released in 1990 by Eric R. Smith, for Atari ST

- **Preemptive multitasking kernel**
- Works on top of TOS
- Device drivers support
- Alternate file system support (MINIX, ext2)
- Long File Names support
- Extends the TOS API (GEMDOS)  
with **UNIX-like features**
- Includes TCP/IP stack

# 1992: Atari MultiTOS

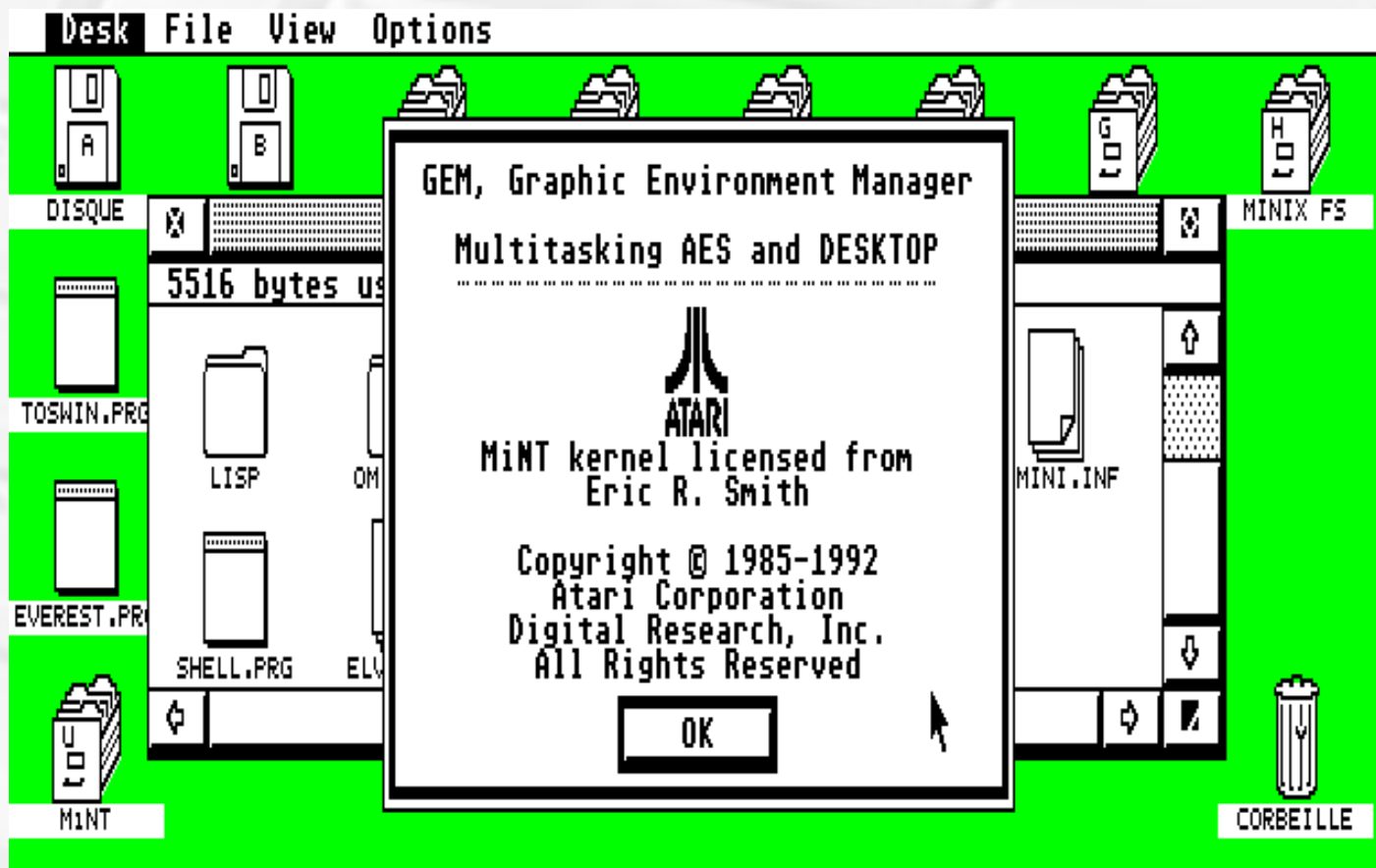
- Atari hired Eric R. Smith
- MultiTOS =
  - MiNT kernel
  - + multitasking AES (user interface)
  - + multitasking desktop
- Nice but a bit slow, needs RAM
- Mainly for high-end TT / Falcon

As MiNT became licensed by Atari,  
as part of MultiTOS,  
it was renamed to...

**MiNT: MiNT is Now TOS**



# MultiTOS on my 4 MB STe



# MiNT compatibility

- Generally good with utilities which respect the OS
- Multitasking is disabled when programs switch to supervisor mode
- No virtual memory, but optional **memory protection**: stricter memory checking, can affect some programs

# MiNT could be compared to...



- Windows 95 running on top of MS-DOS
- Clean, multitasking API running on top of old single-tasking BIOS

# MiNTLib 1/3

- **C standard library** for major compilers:  
Pure C, C68, GCC...
- Provides **POSIX API**
- Translate POSIX calls at runtime
  - To MiNT system calls if available
  - Otherwise to TOS system calls

# MiNTLib 2/3

- Binaries can automatically take advantage of MiNT features at runtime, when available.
- Example: POSIX directory API *opendir()*, *readdir()*...  
can automatically use Long File Names with MiNT kernel and proper filesystem

# MiNTLib 3/3

- Concretely: Most GNU / Linux software can be built out of the box for MiNT, without specific adaptations.
- When not requiring advanced OS features, binaries can even run on plain TOS.  
Example: tar

# MiNTLib could be seen as...



- A static library which provides similar functionality as Cygwin environment for Windows.
- Even transparent CR/LF translation is supported.

# bash & C68 running on MiNT

```
/c/vincent/c/hello>echo $BASH_VERSION
1.14.0(1)
/c/vincent/c/hello>uname -a
TOS/MiNT ? Jan 1990 1.62/1.12 Atari STE
/c/vincent/c/hello>ll
-rw-rw----  1 root      sys           134 Nov 20 00:06 hello.c
/c/vincent/c/hello>cc68x hello.c -o hello -v
cpp -S -D__TOS__ -D__C68__ -D__MSHORT__ -ansi -T hello.c u:\tmp\hello.i
c68 u:\tmp\hello.i u:\tmp\hello.s
as68 u:\tmp\hello.s u:\tmp\hello.o
rm -f u:\tmp\hello.i
rm -f u:\tmp\hello.s
ld -o hello crt0.o u:\tmp\hello.o u:\usr\lib\libc.a
rm -f u:\tmp\hello.o
/c/vincent/c/hello>ll
-rw-rw----  1 root      sys           134 Nov 20 00:06 hello.c
-rw-rw----  1 root      sys        15336 Nov 20 00:12 hello
/c/vincent/c/hello>./hello
Hello, World!
/c/vincent/c/hello>■
```



# 1997: End of my first Atari era

- Pushed my Atari STe to its limits.
- Not enough CPU for my needs, specially exercises of image processing.
- Time to switch to something faster.

**Meanwhile,  
on the Atari scene...**

A pixelated black and white graphic of a character, possibly a robot or a creature, standing on a keyboard. The character is composed of black and white pixels, giving it a retro, digital appearance. It has a rounded body, a small head, and a tail-like appendage. The background of the slide is a blurred image of a computer keyboard, with keys like 'W', 'E', 'R', 'T', 'Y', 'U', 'I', 'O', 'P', 'A', 'S', 'D', 'F', 'G', 'H', 'J', 'K', 'L', 'Z', 'X', 'C', 'V', 'B', 'N', 'M', and 'Enter' visible. The text 'Meanwhile, on the Atari scene...' is centered at the top in a bold, black, sans-serif font. The overall aesthetic is nostalgic and tech-oriented.

Vincent Rivière, foss-north 2018, Gothenburg, 23/04/2018

38/157



# Other Atari machines...

- Mega ST
- STe
- Mega STe
- TT: 68030
- **Falcon**: 68030 + DSP
- Clones: Hades, Milan...
- Accelerators: CT60...



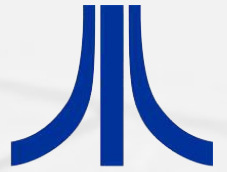
# NVDI



- Commercial software from Behne & Behne Systemsoftware
- **Fast** replacement of the **VDI** layer  
Visible speedup with on any machine
- Improved graphics driver
- Support for graphics cards (closed API)
- Printing driver



# Atari company 1/2



- 1993: Atari **stopped** all computer activities, focusing only on the Jaguar console, then only on game licenses.
- Owner changed several times:
  - 1996: JTS Corporation
  - 1998: Hasbro Interactive
  - 1999: Infogrames
  - 2009: Infogrames is renamed to Atari



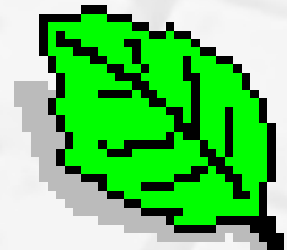
# Atari company 2/2



- All TOS-related software, including ROMs, is now unofficially considered as **abandonware**
- But concretely, that software is still under the Atari copyright, closed source.
- Who owns the rights of TOS today?  
⇒ **legally unusable**

# Special case of MiNT kernel

- Provided as open source:  
Copyright 1990,1991,1992 Eric R. Smith.  
Copyright 1992,1993,1994 Atari Corporation.
- Supported by people on the MiNT Mailing List
- Renamed to **FreeMiNT** kernel
- 2000: Put into CVS



# SpareMiNT distribution

- FreeMiNT kernel
- GCC 2.x + MiNTLib
- **RPM** packages (Red Hat)
- Huge efforts to provide a full UNIX-like environment: many, many Free packages mostly from GNU/Linux.



**SpareMiNT**  
The FreeMiNT Software Archive

2000~2010



# 1997-2003: My C++ period

- Obsessed by C++, Object-Oriented Programming, templates, unit tests.
- Considered using C++ to create a multi-platform framework for games.
- Wanted recent **GCC cross-compiler** for GameBoy Advance.
- Started training with GCC cross-compiler for my favorite target... the **Atari ST** 🤪

# Patrice Mandin's **invaluable** work

SpareMiNT  
binutils and  
GCC 2.x  
patches  
upgraded to  
**GCC 3.x**  
  
Everything  
**clearly**  
explained

## Build an Atari cross-compiler for Linux

### gcc 3.3 and binutils 2.13.2.1

This text tries to explain the steps to follow to setup the necessary tools to cross-compile m68k-atari-mint software on a different machine.

I have used the available patches from the [Sparemint](#) site, along with the original (gcc & binutils) archives.

These are the steps I followed to build these utilities. The power of recent machines are well superior to the Ataris, the compilation time for heavy software is greatly reduced, so we might as well use them.

Note: The mintlib is necessary (binaries and include files) to compile a cross-compiler. If you know how to build a cross-compiler only with sources files, please let me know.

### Etape 1: Get the necessary archives

- Binutils sources:  
[binutils-2.13.2.1.tar.gz](#)
- MiNT patch for binutils :  
[binutils-2.13.2.1-mint-2.diff.gz](#) (21 KB)
- Gcc sources:  
[gcc-3.3.tar.gz](#)
- MiNT patch for gcc :  
[gcc-3.3-mint.diff.gz](#) (5 KB)
- Compiled mintlib (include and lib):  
[mintlib-devel-0.57.3.tar.gz](#)



I spent several **\*years\***

- working alone
- upgrading versions
- fighting old and new bugs
- getting help from binutils/GCC mailing lists and Bugzilla

# July 2007: First public release!

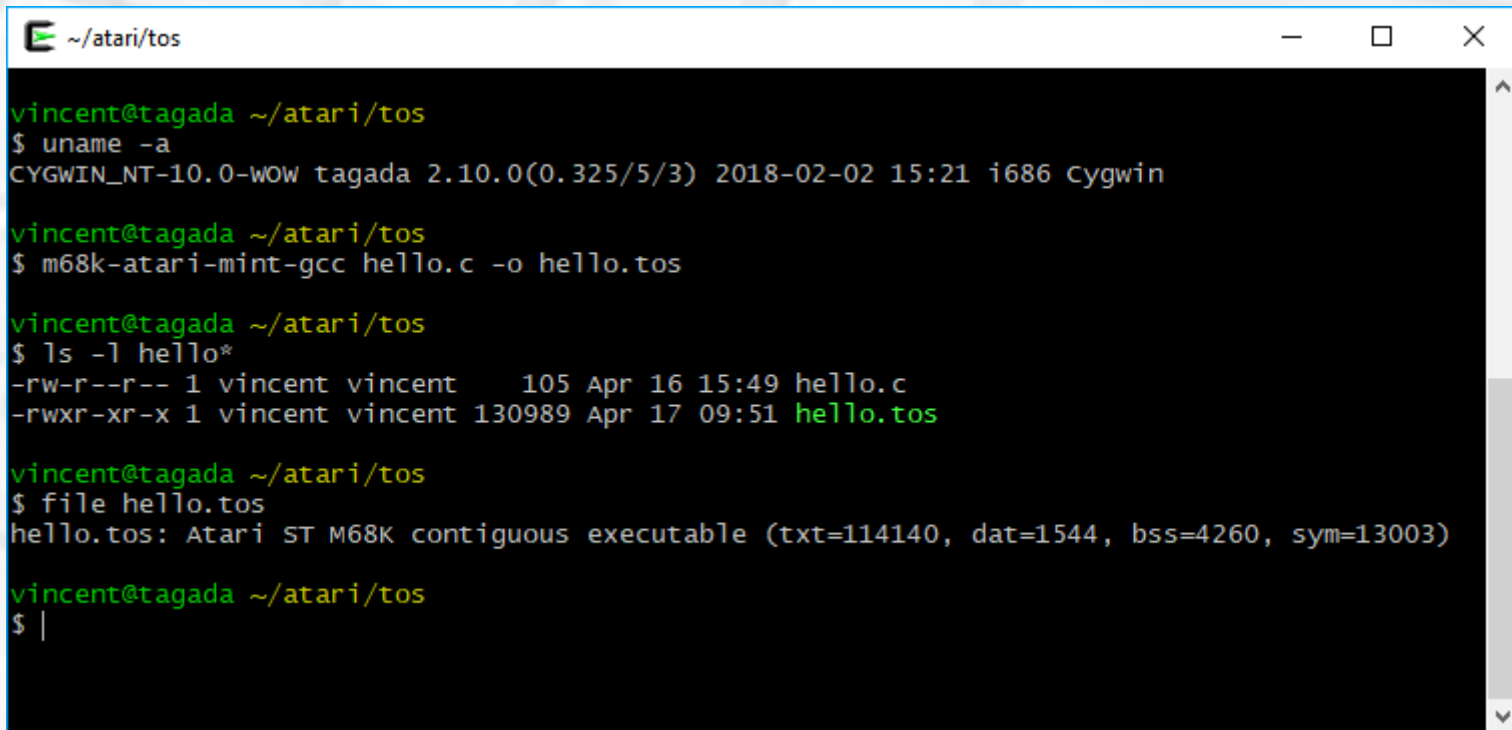
Vincent Rivière's m68k-atari-mint cross-tools

<http://vincent.riviere.free.fr/soft/m68k-atari-mint/>

- Ready-to use cross-tools binaries for **Cygwin**
- Packages: binutils, **GCC 4.x**, MiNTLib, PML...
- Carefully respected **GPL requirements**:  
Original sources, MiNT patches,  
build scripts, binary packages

# Cygwin

## Full UNIX-like environment for Windows



```
~ /atari/tos
vincent@tagada ~/atari/tos
$ uname -a
CYGWIN_NT-10.0-WOW tagada 2.10.0(0.325/5/3) 2018-02-02 15:21 i686 cygwin

vincent@tagada ~/atari/tos
$ m68k-atari-mint-gcc hello.c -o hello.tos

vincent@tagada ~/atari/tos
$ ls -l hello*
-rw-r--r-- 1 vincent vincent 105 Apr 16 15:49 hello.c
-rwxr-xr-x 1 vincent vincent 130989 Apr 17 09:51 hello.tos

vincent@tagada ~/atari/tos
$ file hello.tos
hello.tos: Atari ST M68K contiguous executable (txt=114140, dat=1544, bss=4260, sym=13003)

vincent@tagada ~/atari/tos
$ |
```

# Cross-tools announces

Usenet Newsgroups:

- `comp.sys.atari.st`
- `fr.comp.sys.atari`

Beginning of my public contributions

# Detailed article about cross-tools



Software Developer's Journal  
Extra  
April 2012

Porting GCC to a new target  
The case of Atari ST computers

Full magazine  
legally available on my website




# Working with the community

- Very good feedback
- Still an active community, using emulators or real hardware
- I was quickly oriented to the **MiNT Mailing List**.



# MiNT Mailing List

- The place where serious things are discussed
- Central place about FreeMiNT, MiNTLib, SpareMiNT, GCC, and MiNT support for real hardware and emulators.
- Address changed several times



**People** taught me  
a lot of things  
about contemporary  
MiNT environments.

Here is the situation I discovered  
in 2007, still valid today.

# Real hardware

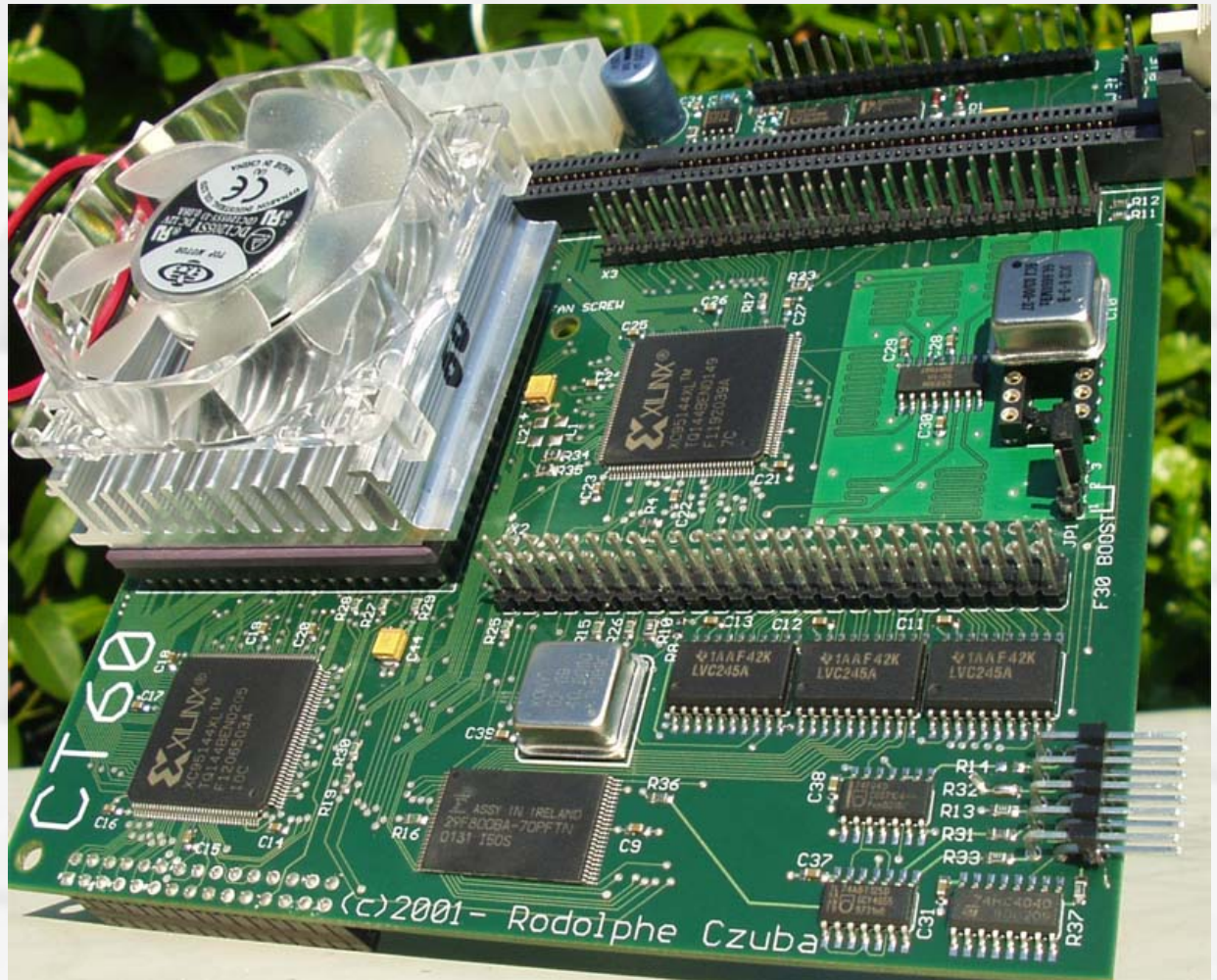
- Most used hardware:  
**Falcon 030 + CT60 accelerator**
  - 68060 CPU @ 66 or 100 MHz
  - SDRAM FastRAM from 64 to 512 MB
- CompactFlash instead of IDE hard disk
- Sometimes: SuperVidel graphics card

# Atari Falcon 030





**CT60**  
accelerator  
for Falcon 030  
  
by  
Rodolphe  
Czuba  
  
68060 CPU  
FastRAM



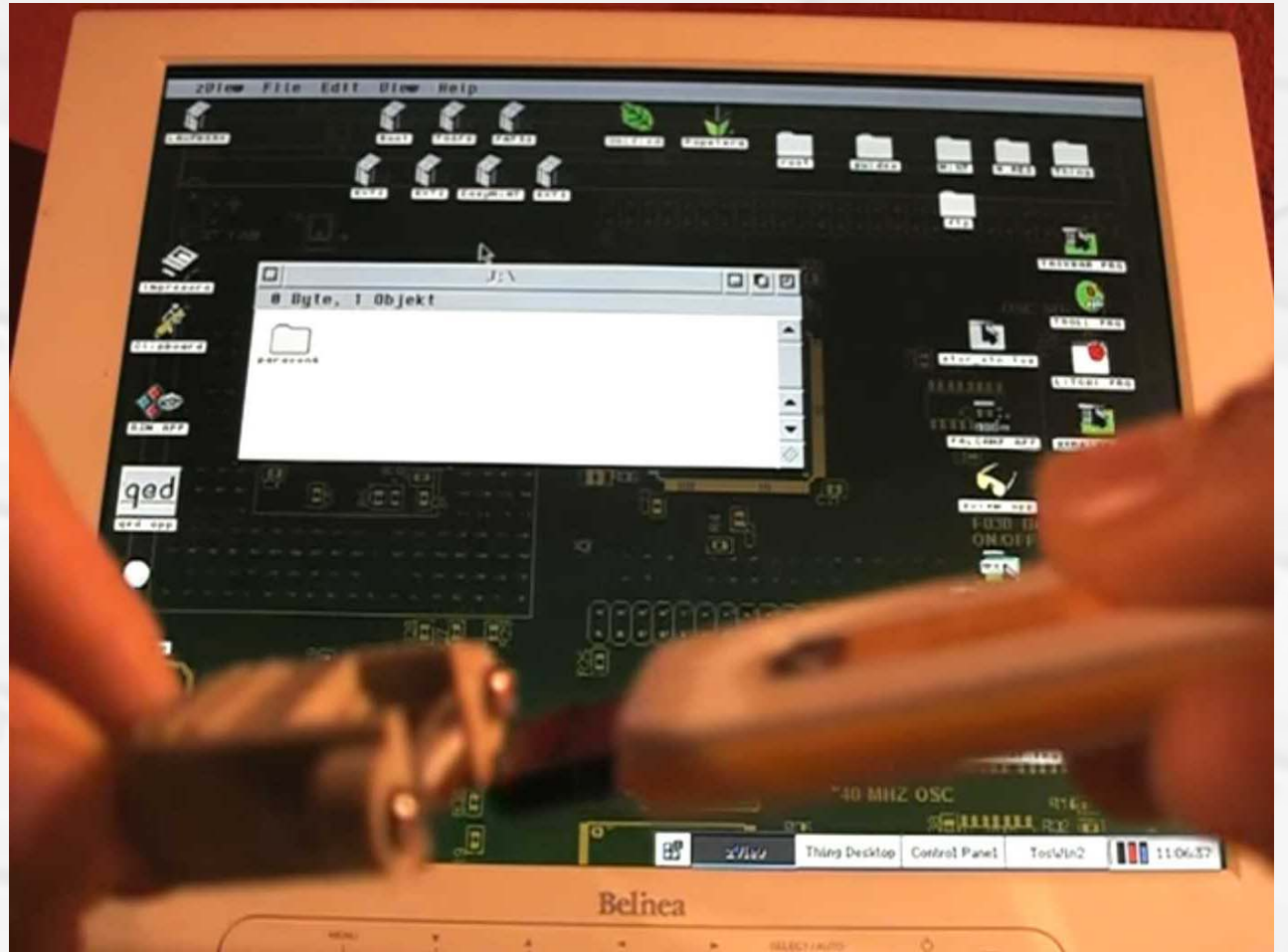
**SuperVidel**  
graphics card  
for CT60  
by  
Nature





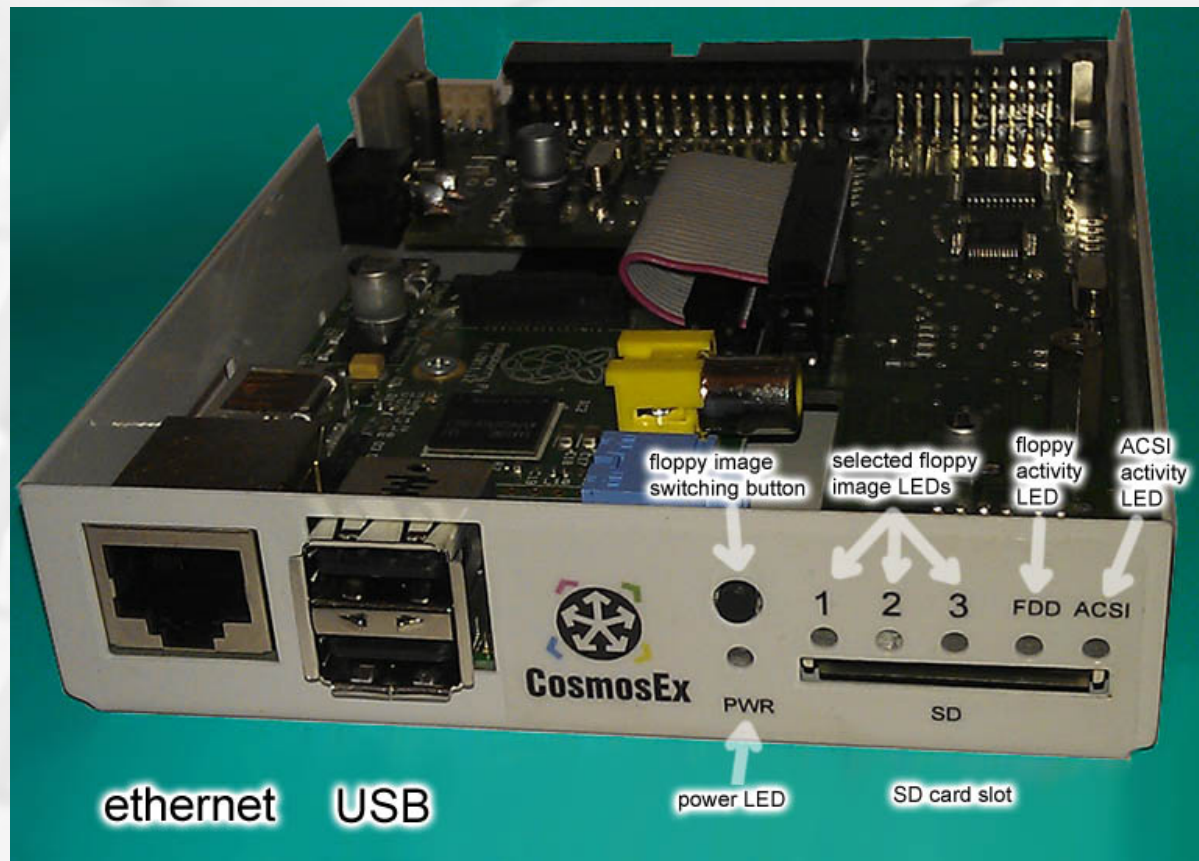
# USB driver for FreeMiNT

by  
David Gálvez



# CosmosEx

Hard disk, floppy,  
USB keyboard  
and mouse,  
network,  
emulated with  
Raspberry Pi  
and SD Card  
by Jookie





# Other hardware 1/2

- **EtherNat:** Ethernet and USB interfaces for the CT60
- **UltraSatan:** ACSI hard disk emulation from SD Card
- **HxC Floppy Emulator:**  
Floppy emulator from SD Card
- **Gotek floppy emulator**  
with HxC or FlashFloppy firmware

## Other hardware 2/2

- **Eiffel interface:** Use PS/2 keyboard and mouse on Atari machines
- **Exxos Store (and forum):** many, many extensions and replacement parts for original Atari hardware
- **Lotharek's Lair:** Many hardware for various machines

# Emulators 1/2

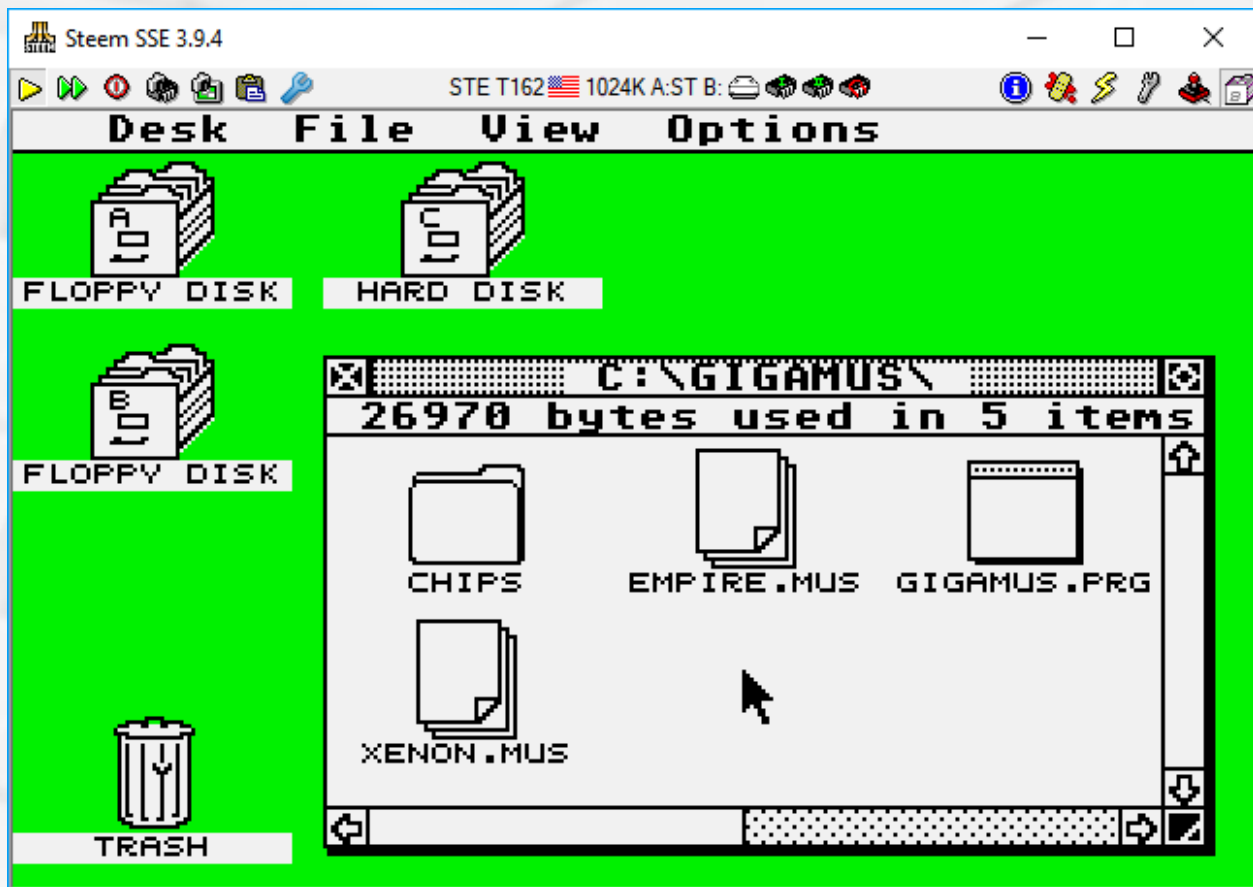
- **ARAnyM**: Atari **R**unning on **A**ny **M**achine  
Partial Falcon emulator + software extensions  
68040 CPU (from WinUAE)  
with optional JIT (Just In Time compiler).  
Mainly developed for Linux.
- Targets **software compatibility**,  
**Native Features**, and **speed**.  
By far, the fastest MiNT environment.

# Emulators 2/2

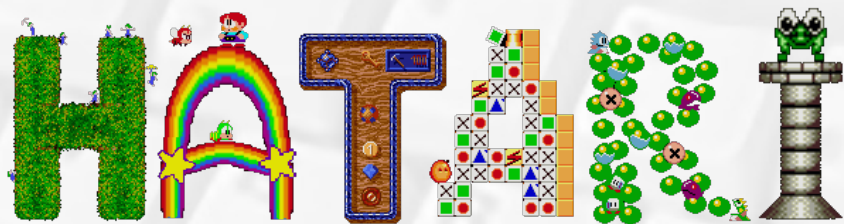
- **Hatari**: ST / STe / TT / Falcon emulator  
Many custom combinations : CPU, etc.  
Mainly developed for Linux.
- **Steem SSE**: ST / STe emulator  
Mainly developed for Windows.
- Both target **accurate hardware emulation**,  
but few software extensions.  
Rarely used with MiNT.

# Steem SSE

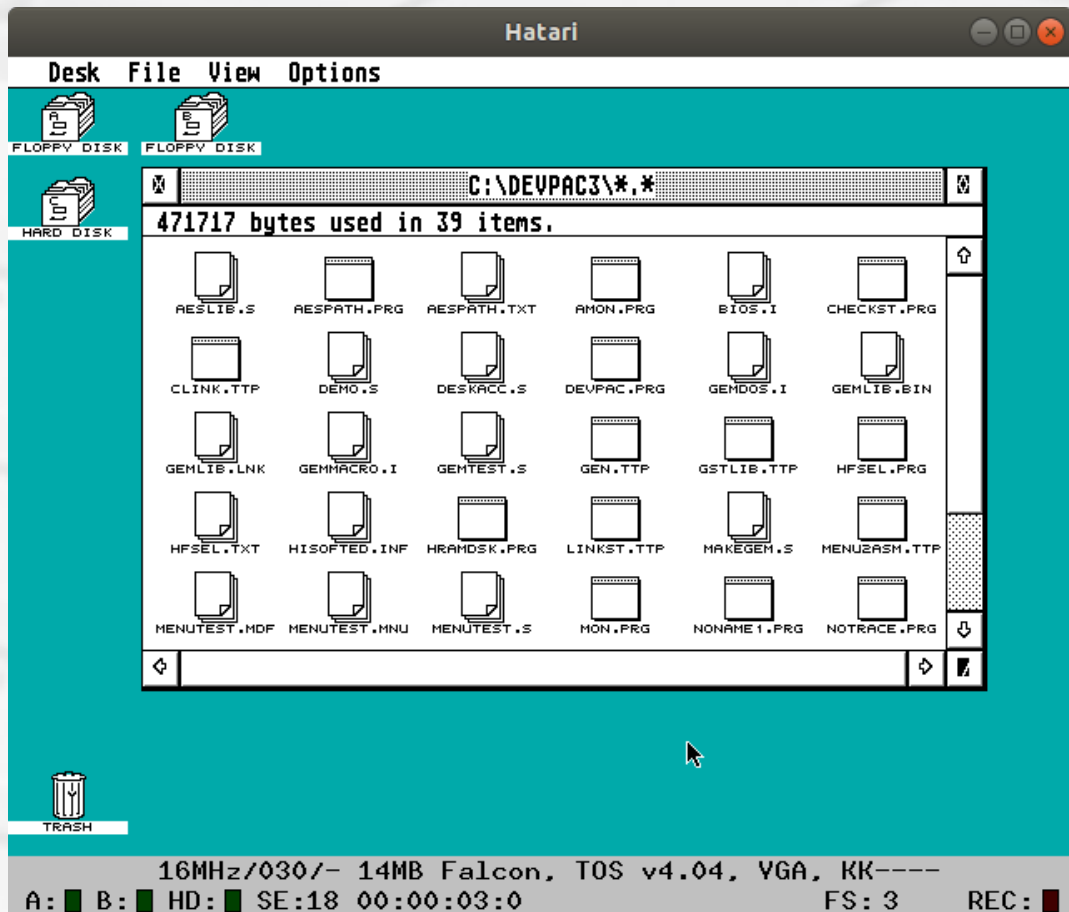
Fork of original  
Steem Engine  
by  
Steven Seagal



# Hatari



Example:  
Falcon emulation,  
hard disk  
emulated  
from host folder

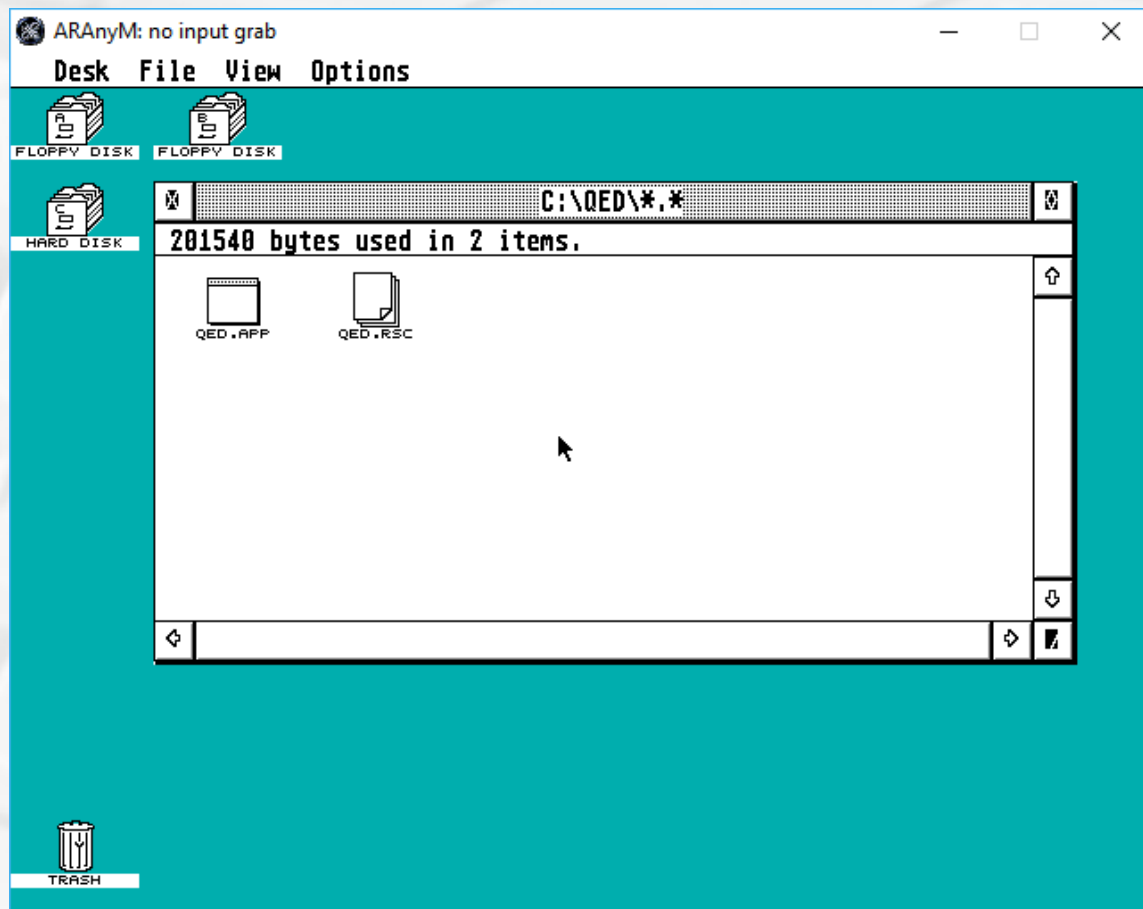




# ARAnyM 1/2

Partial  
Falcon emulation  
with 68040  
+ extensions

Calls itself  
“Virtual Machine”



# ARAnyM 2/2

Many unique features available through “NatFeats”

Requires specific drivers.

Designed for **fastest possible experience**.

- Debug output
- Extended True Color video modes
- Accelerated graphics
- Access to Host Filesystem
- Network, SCSI, mass storage...



# EmuTOS 1/4

**Free (GPL)**  
Operating  
System  
compatible  
with TOS

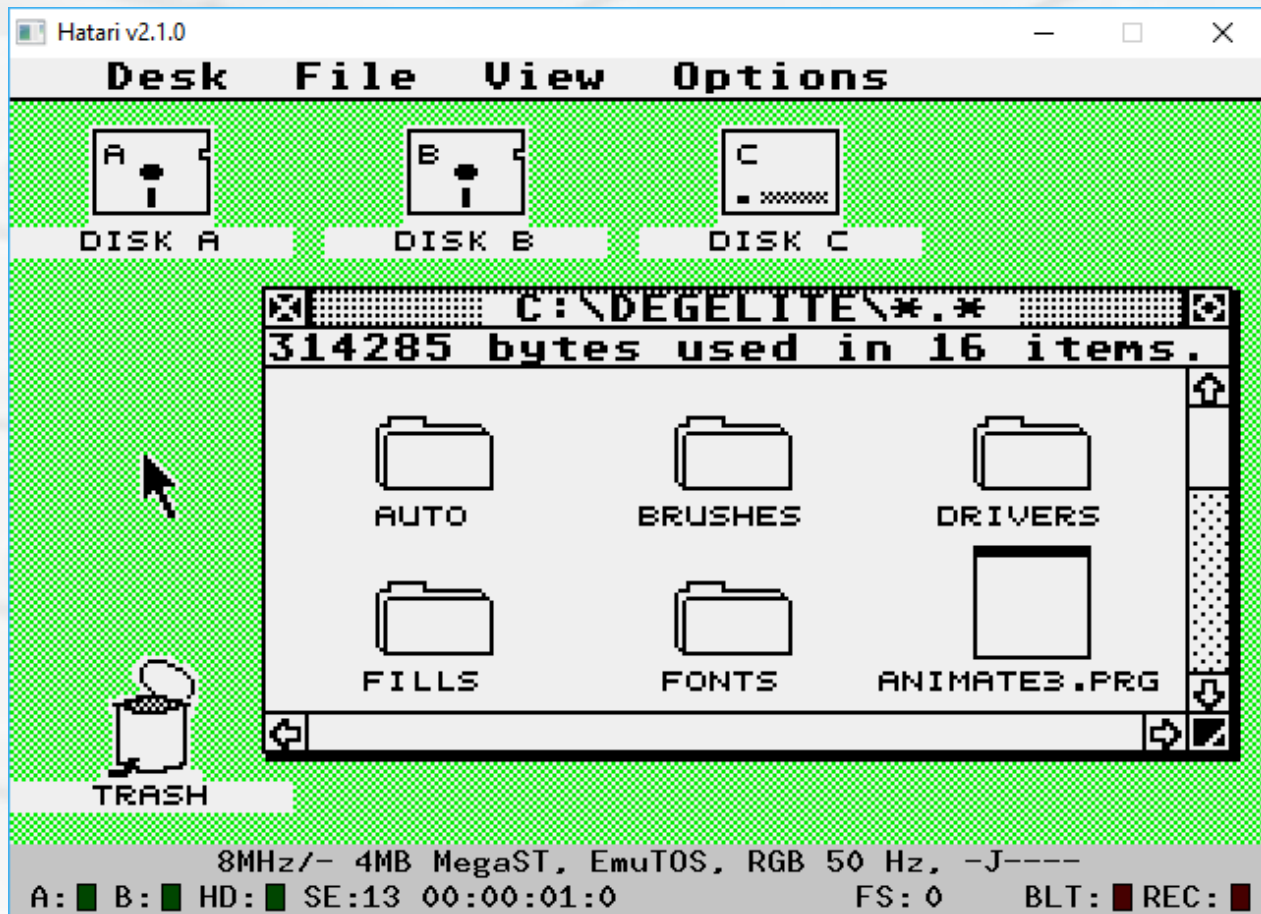
Alternative  
to Atari ROMs



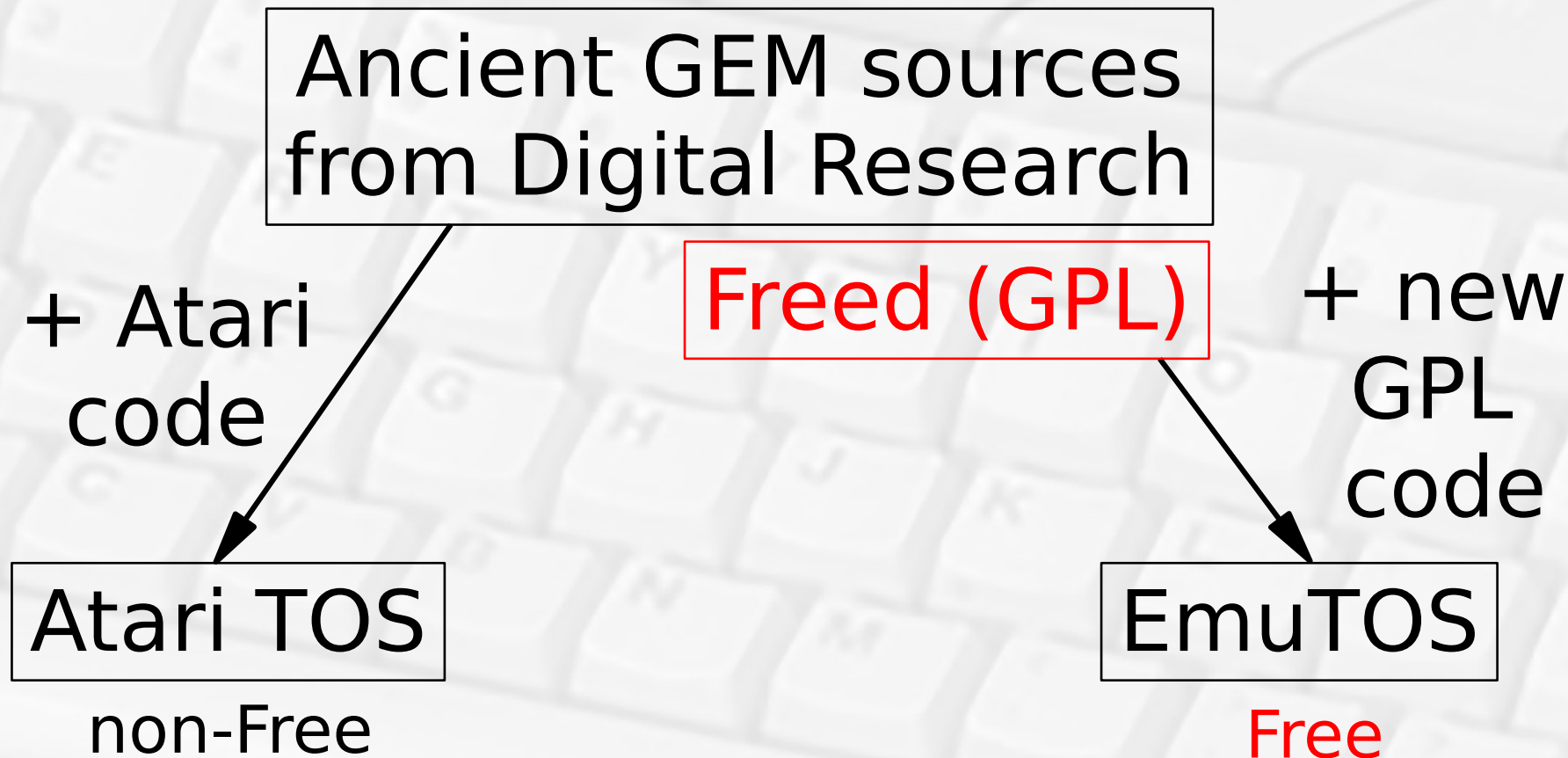
# EmuTOS 2/4

Similar  
system  
to Atari TOS

But  
different  
implemen-  
tation



# EmuTOS 3/4



# EmuTOS main features 4/4

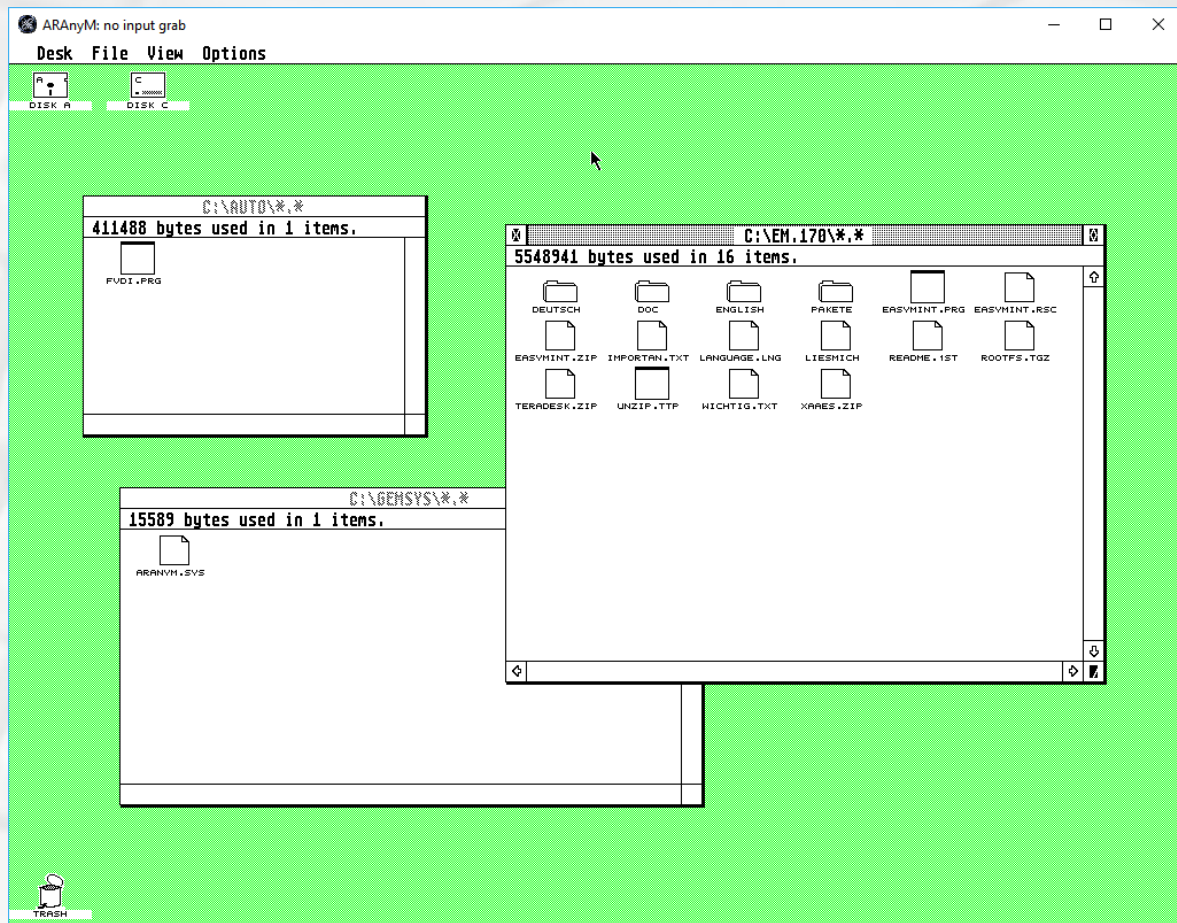
- Supports all Atari computers
- Provided as many variants, 9 languages
  - ROM, mainly for emulators
  - RAM, as floppy or PRG, for real hardware
- Can even support non-Atari machines
- Built-in **hard-disk driver**
- Atari or PC partition tables, FAT16 partitions
- Built-in EmuCON command-line interpreter

# fVDI 1/2

- New **VDI implementation** (graphics driver) by Johan Klockars
- Free Software (GPL)
- Supports **external drivers** with public API
- Explicit support for **ARAnyM extended video modes**

# fVDI 2/2

ARAnyM,  
EmuTOS  
and fVDI  
  
in 1024x768  
32-bit

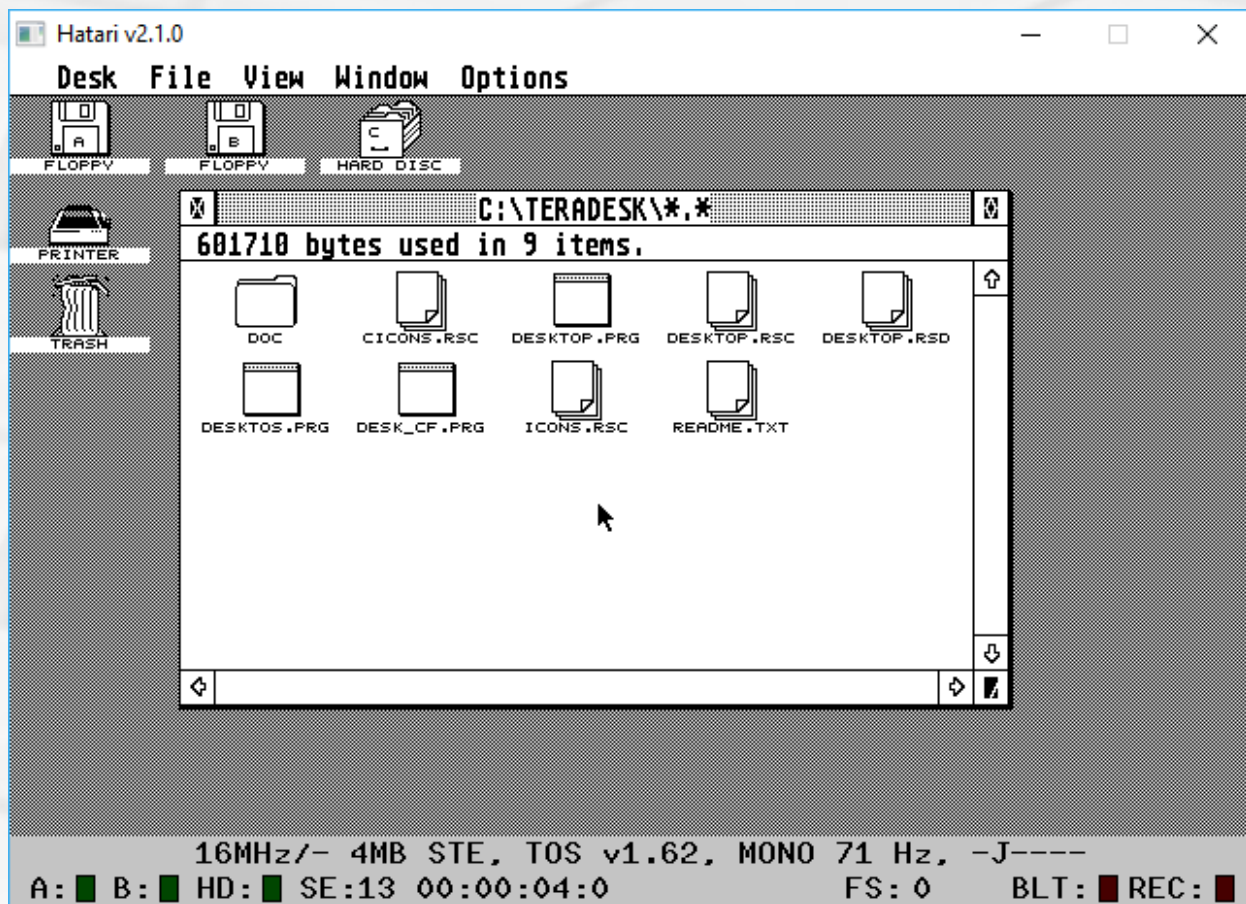


# Tera Desktop 1/2

- Improved GEM desktop
- Free Software (GPL)
- Supported since 1991!
- Support for multitasking AES like MultiTOS, XaAES, MyAES...

# Tera Desktop 2/2

Hatari,  
STe emulation,  
high resolution,  
Tera Desktop



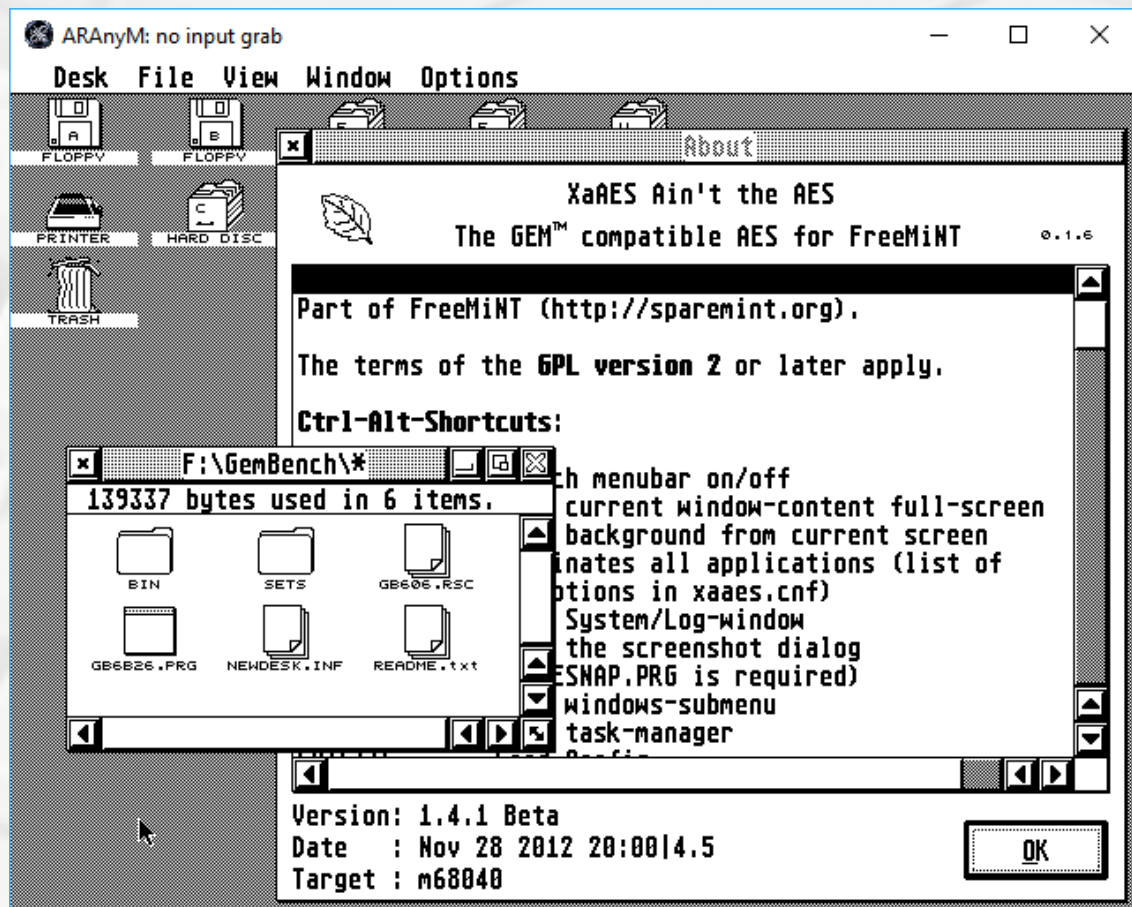


# XaAES 1/2

- **Multitasking AES** for FreeMiNT  
(windowed environment)
- Free Software (GPL)  
**provided with FreeMiNT**
- Requires an alternative desktop  
such as Tera Desktop

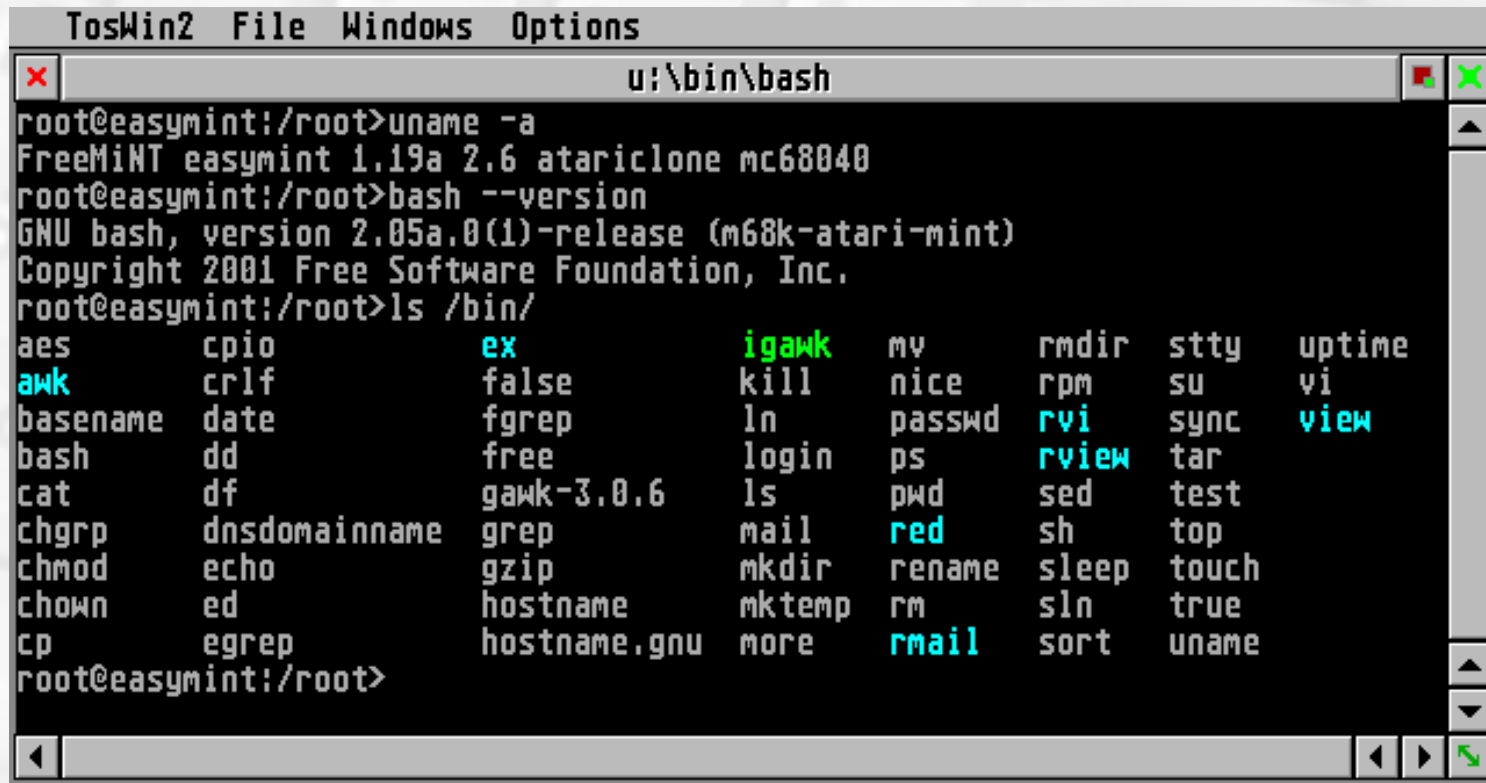
# XaAES 2/2

ARAnyM,  
EmuTOS,  
FreeMiNT,  
XaAES,  
Tera Desktop



# TosWin2

## Windowed terminal emulator



The image shows a screenshot of the TosWin2 windowed terminal emulator. The window has a title bar with the text "TosWin2 File Windows Options". Below the title bar is a menu bar with the same text. The main area of the window is a black terminal with white text. The prompt is "root@easymint!:/root>". The user has entered the command "uname -a" and the output is "FreeMiNT easymint 1.19a 2.6 atariclone mc68040". The user has entered the command "bash --version" and the output is "GNU bash, version 2.05a.0(1)-release (m68k-atari-mint) Copyright 2001 Free Software Foundation, Inc.". The user has entered the command "ls /bin/" and the output is a list of files in the /bin/ directory, including aes, awk, basename, bash, cat, chgrp, chmod, chown, cp, cpio, crlf, date, dd, df, dnsdomainname, echo, ed, egrep, ex, false, fgrep, free, gawk-3.0.6, grep, gzip, hostname, hostname.gnu, igawk, kill, ln, login, ls, mail, mkdir, mktemp, more, mv, nice, passwd, ps, pwd, red, rename, rm, rmail, rmdir, rpm, rvi, rview, sed, sh, sleep, sln, sort, stty, su, sync, tar, test, top, touch, true, uptime, vi, and view.

```
TosWin2 File Windows Options
u:\bin\bash
root@easymint!:/root>uname -a
FreeMiNT easymint 1.19a 2.6 atariclone mc68040
root@easymint!:/root>bash --version
GNU bash, version 2.05a.0(1)-release (m68k-atari-mint)
Copyright 2001 Free Software Foundation, Inc.
root@easymint!:/root>ls /bin/
aes          cpio          ex            igawk         mv           rmdir        stty         uptime
awk          crlf          false         kill          nice        rpm          su          vi
basename     date          fgrep         ln            passwd       rvi          sync        view
bash         dd            free          login         ps           rview       tar
cat          df            gawk-3.0.6   ls            pwd          sed          test
chgrp        dnsdomainname grep           mail          red          sh           top
chmod        echo          gzip          mkdir         rename       sleep        touch
chown        ed            hostname     mktemp        rm           sln          true
cp           egrep         hostname.gnu more           rmail        sort         uname
```

# API Documentation

**tos.hyp**

by Gerhard Stoll

# Putting all together...

- ARAnyM
- EmuTOS
- FreeMiNT
- XaAES
- Tera Desktop
- and more...

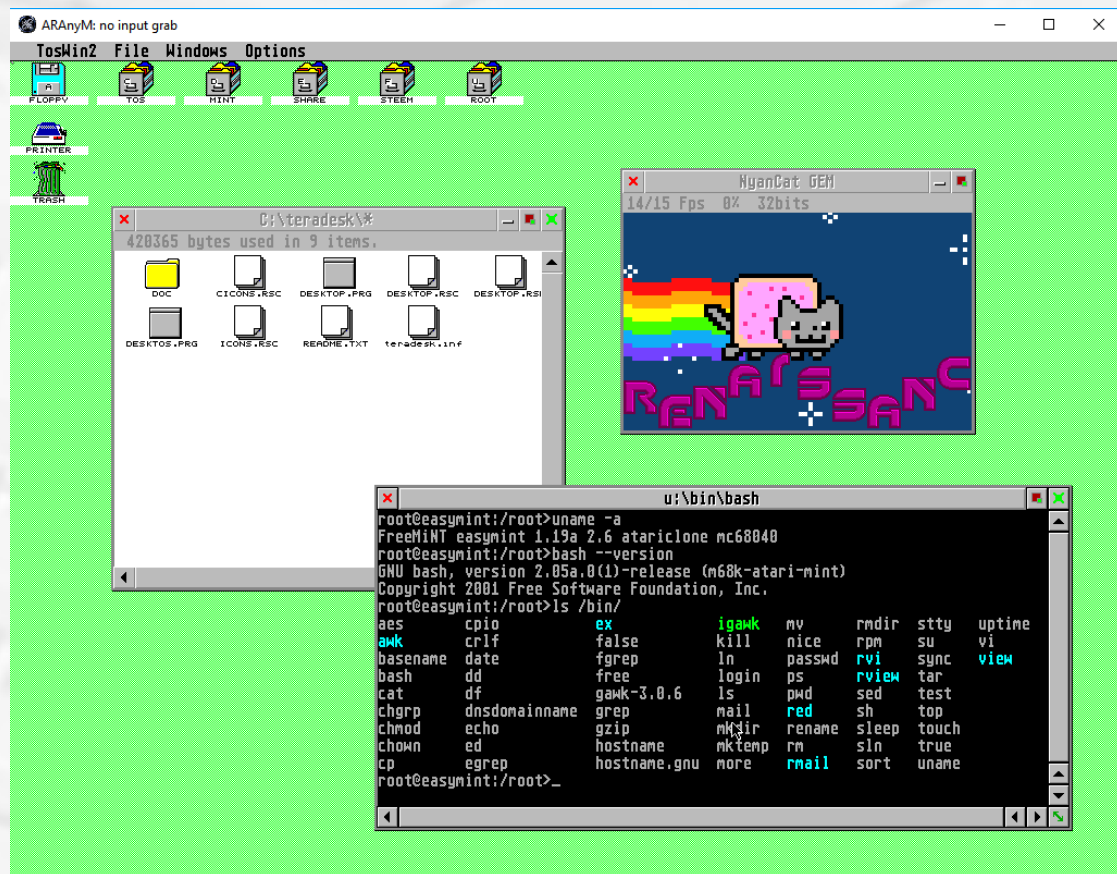
# EasyMiNT installer

- A **user-friendly installer** for SpareMiNT distribution
- By Marc-Anton Kehr
- Discontinued in 2015 with version 1.90



# Example installation

ARAnyM  
EmuTOS  
FreeMiNT  
fVDI  
XaAES  
Tera Desktop  
TosWin2  
bash  
NyanCat



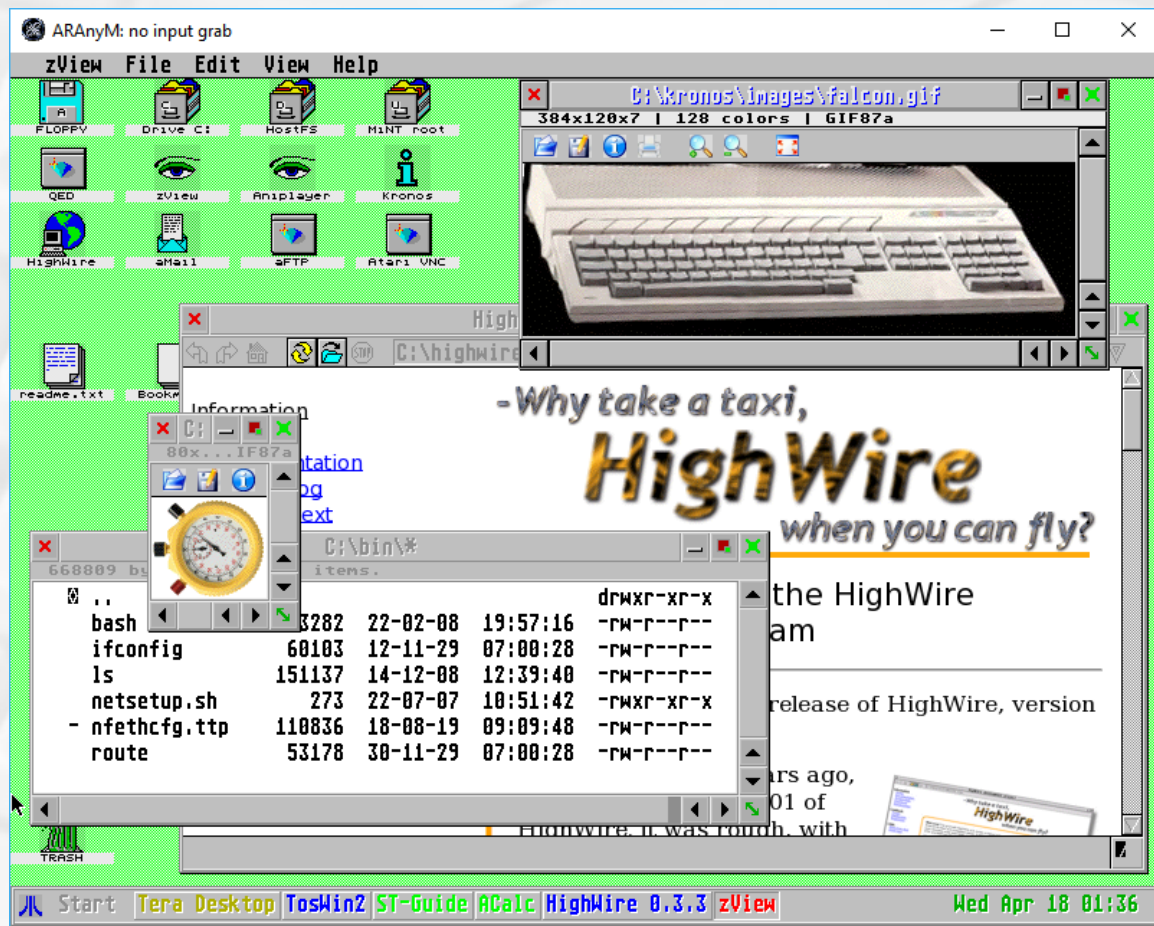


# AFROS

## Atari FRee Operating System

Distribution  
for ARAnyM  
+ Live CD  
based on  
Slax Linux

by Petr Stehlík





# miniPack

Distribution  
for ARAnyM

Supports  
Windows, Linux,  
Macintosh,  
PlayStation 3  
by François  
LE COAT

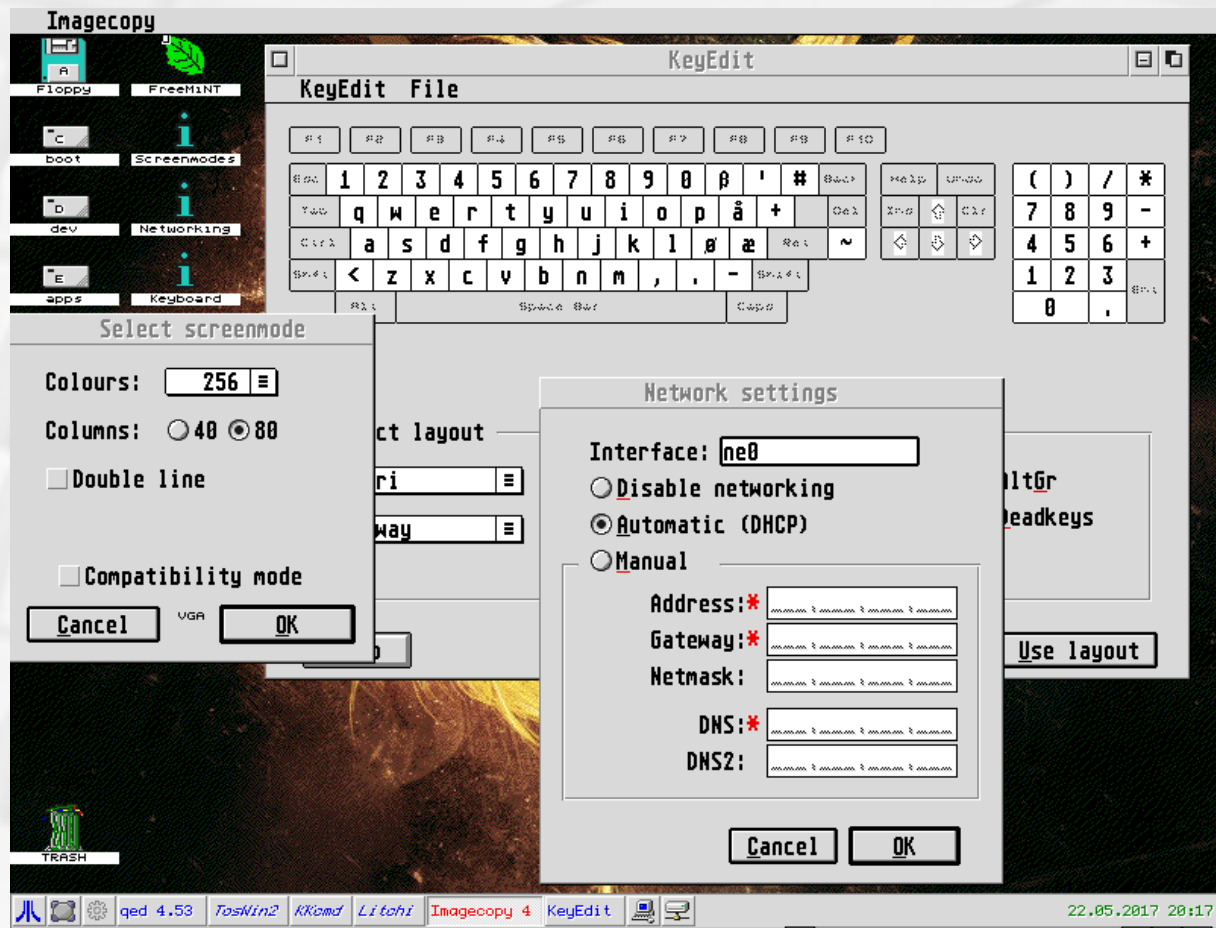


# VanillaMiNT

## VanillaMiNT

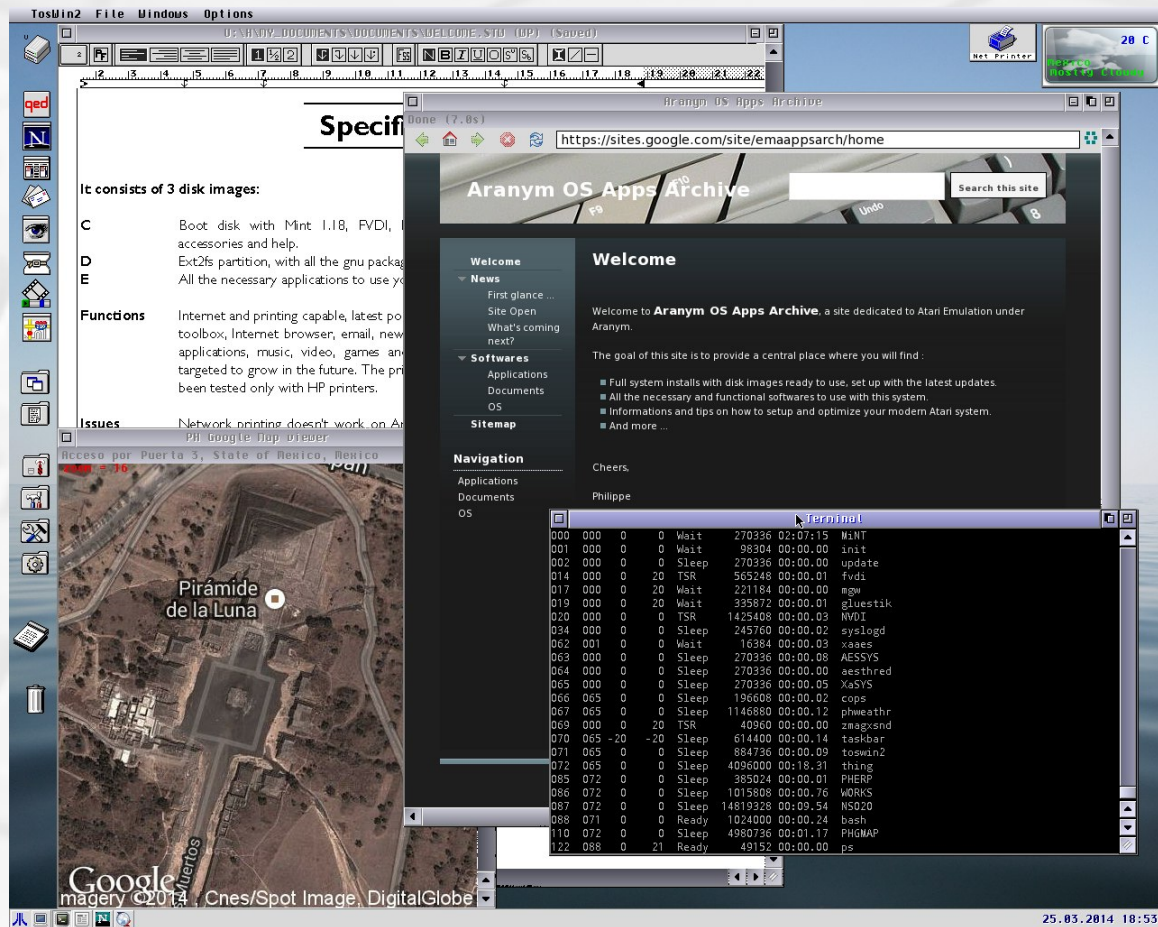
Simple  
FreeMiNT  
distribution  
for 68030  
and higher

by  
Jo Even  
Skarstein



# EasyAraMiNT

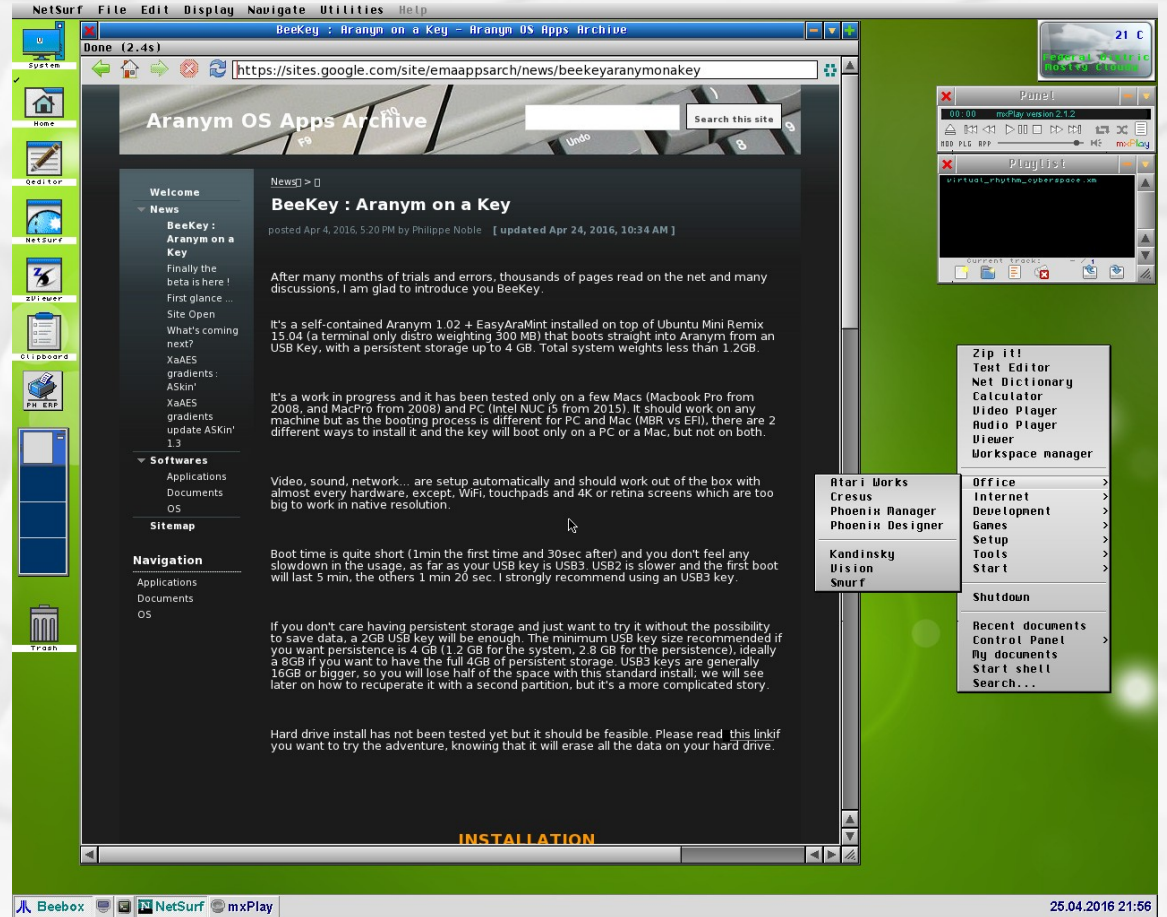
FreeMiNT  
distribution  
for  
ARAnyM  
by  
Philippe Noble



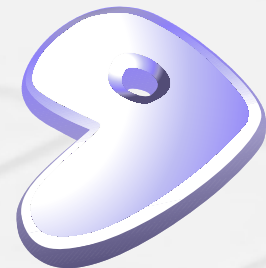


# BeeKey / BeePi

Live distribution  
of ARAnyM  
for PC / Mac  
/ Raspberry Pi  
based on  
minBian  
by  
Philippe Noble



# Gentoo FreeMiNT



Port of Gentoo distribution  
over FreeMiNT kernel

By Alan Hourihane  
(mirror)

# Some remarkable software...



# NetSurf

## Web Browser

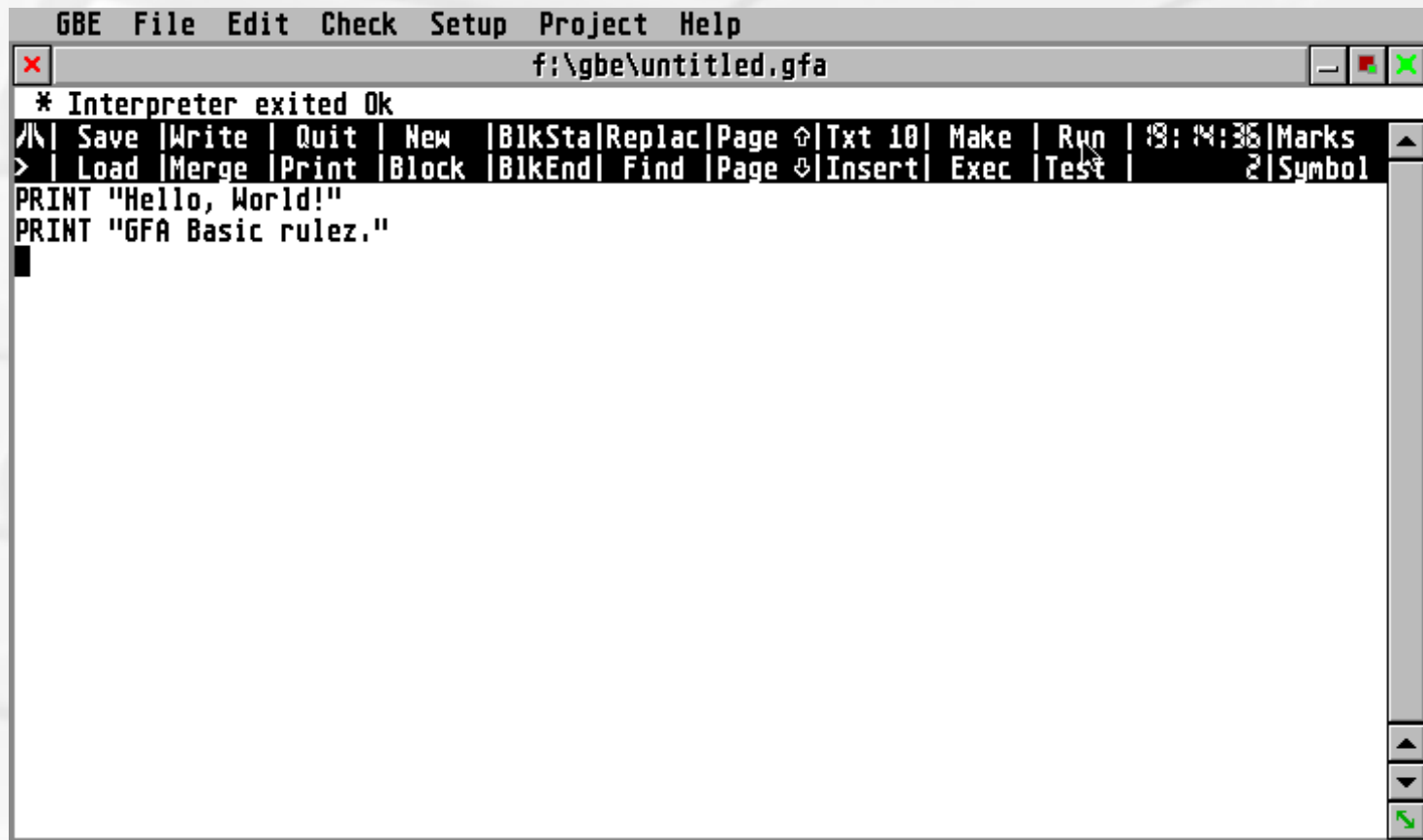
ported by  
Ole Loots





# GFA Basic Editor

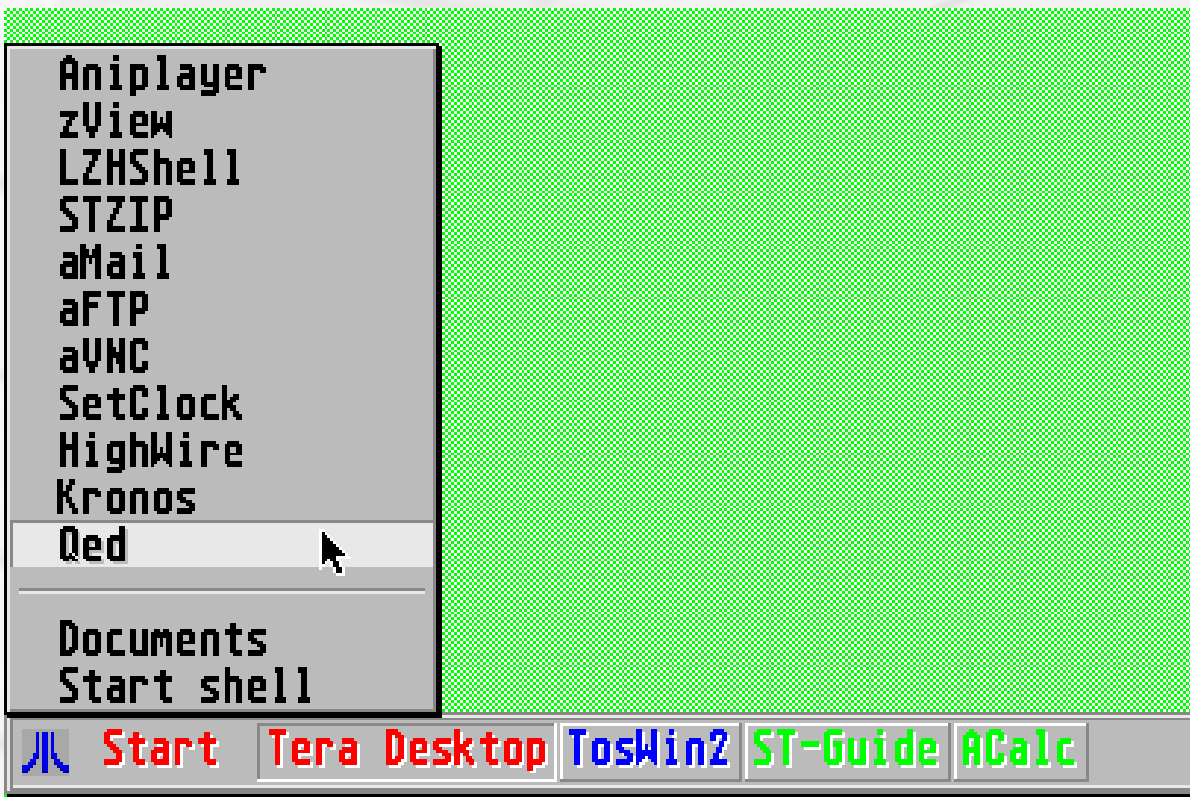
Maintained  
by  
Lonny  
Pursell



# Taskbar

Taskbar  
launcher

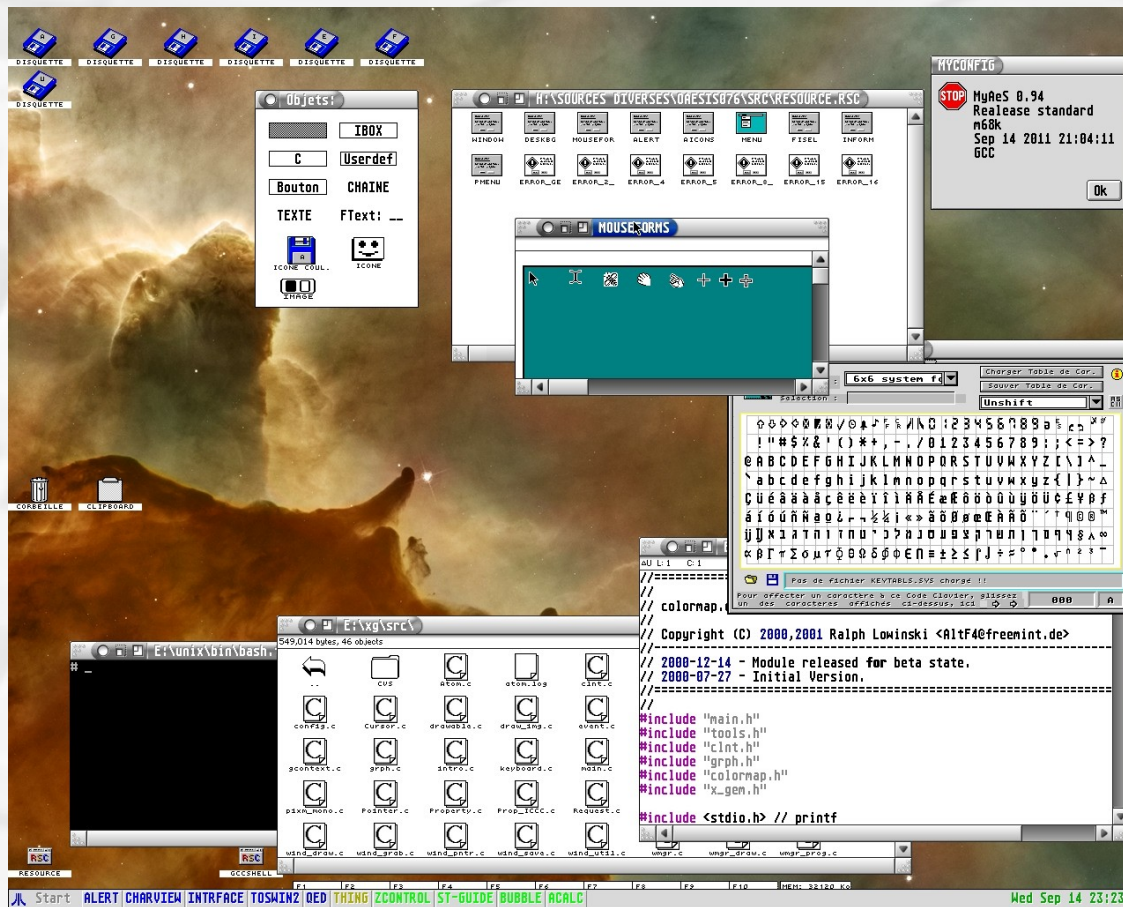
by  
Jo Even  
Skarstein



# MyAES

Full AES  
replacement,  
alternative  
to XaAES

by  
Olivier  
Landemarre

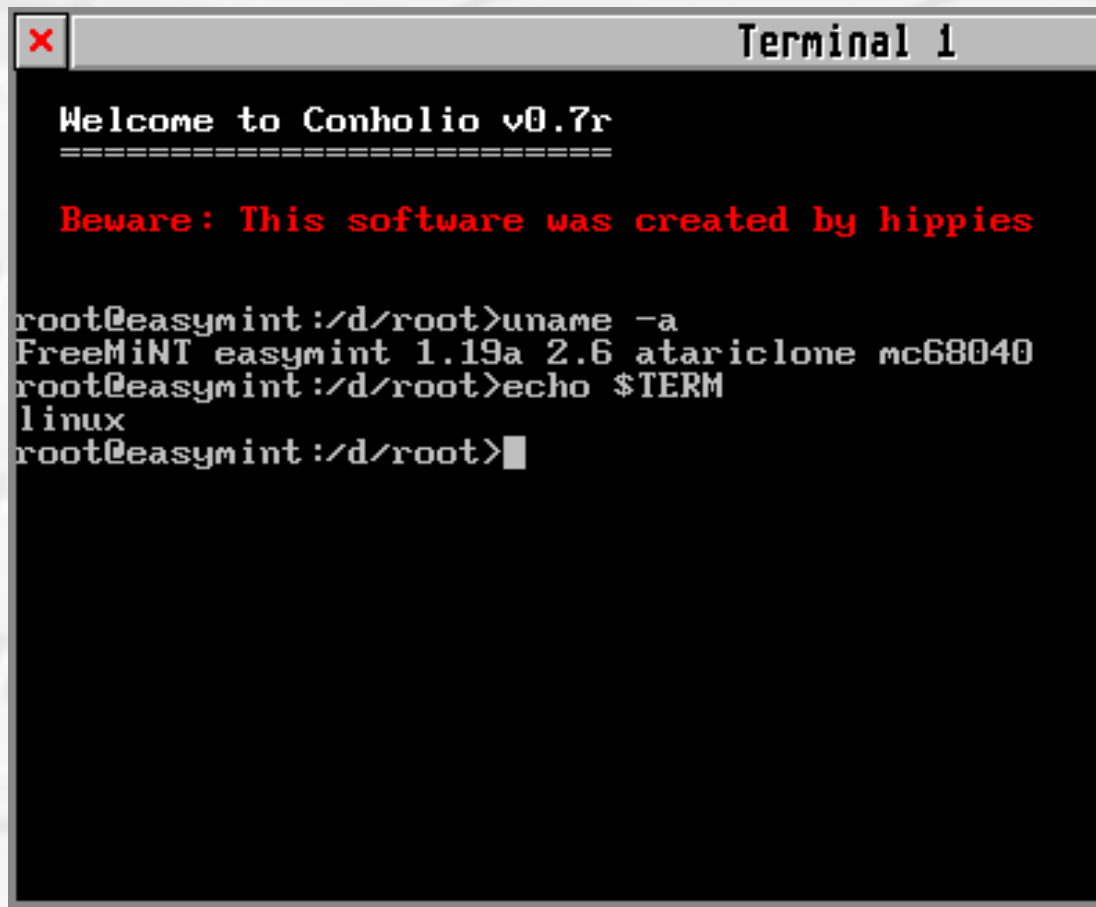


# Conholio

Terminal  
emulator  
by

Peter Persson

Based on Linux  
virtual consoles

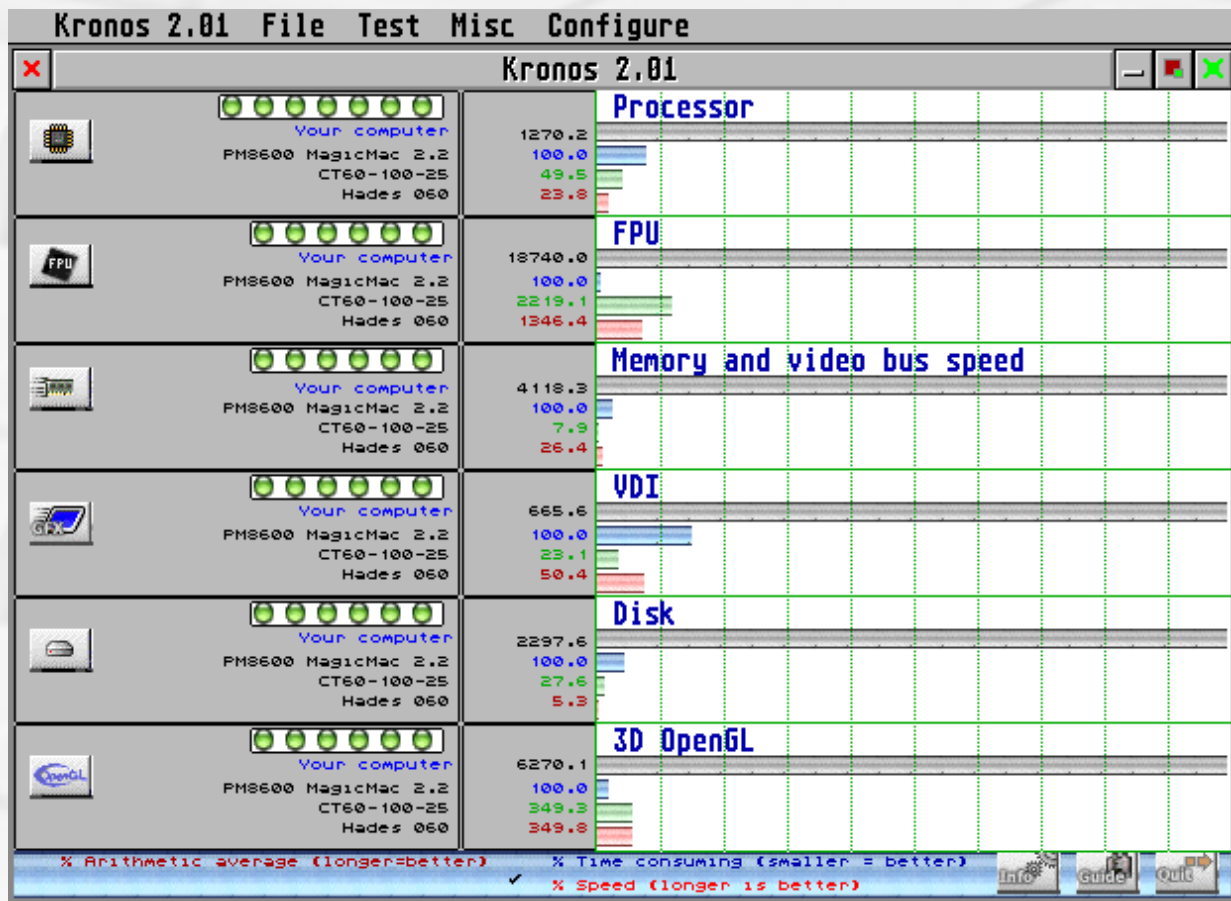
A screenshot of a terminal window titled "Terminal 1". The window has a standard macOS-style title bar with a red close button. The terminal content shows a welcome message, a warning in red, and a series of shell commands and their outputs.

```
x Terminal 1
Welcome to Conholio v0.7r
=====
Beware: This software was created by hippies

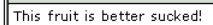
root@easymint:/d/root>uname -a
FreeMiNT easymint 1.19a 2.6 atariclone mc68040
root@easymint:/d/root>echo $TERM
linux
root@easymint:/d/root>|
```

# Kronos

Benchmark  
by  
Olivier  
Landemarre



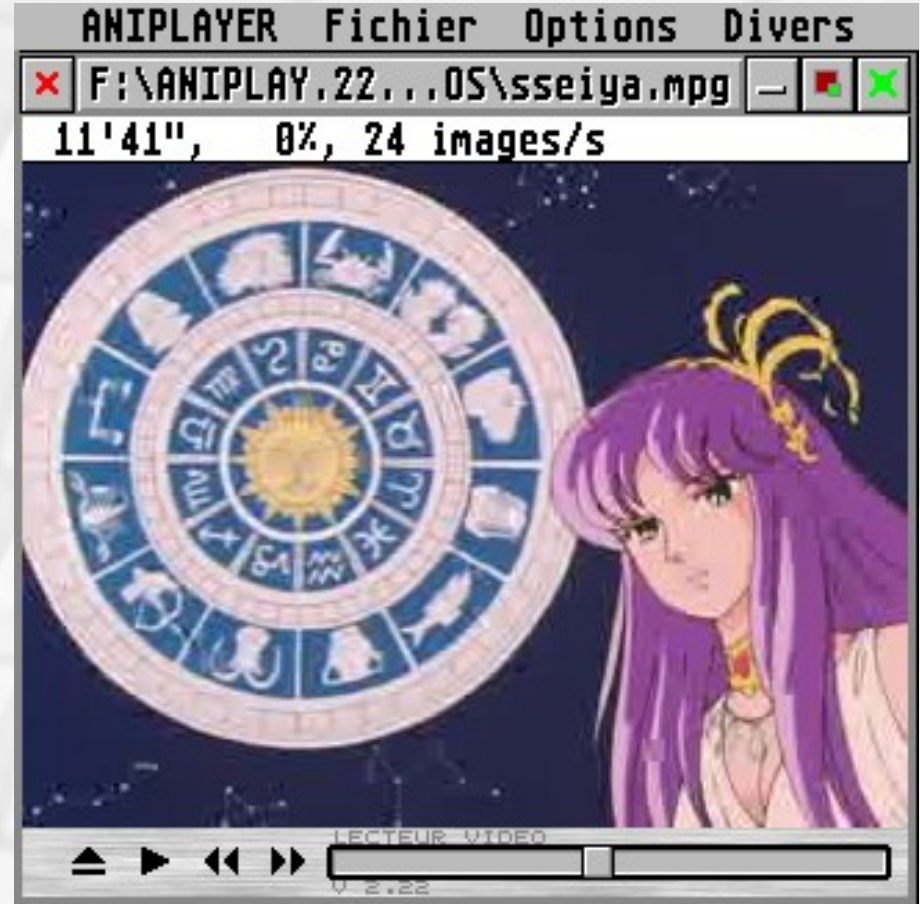
# FTP client with SSL support by Rajah Lone





# Aniplayer

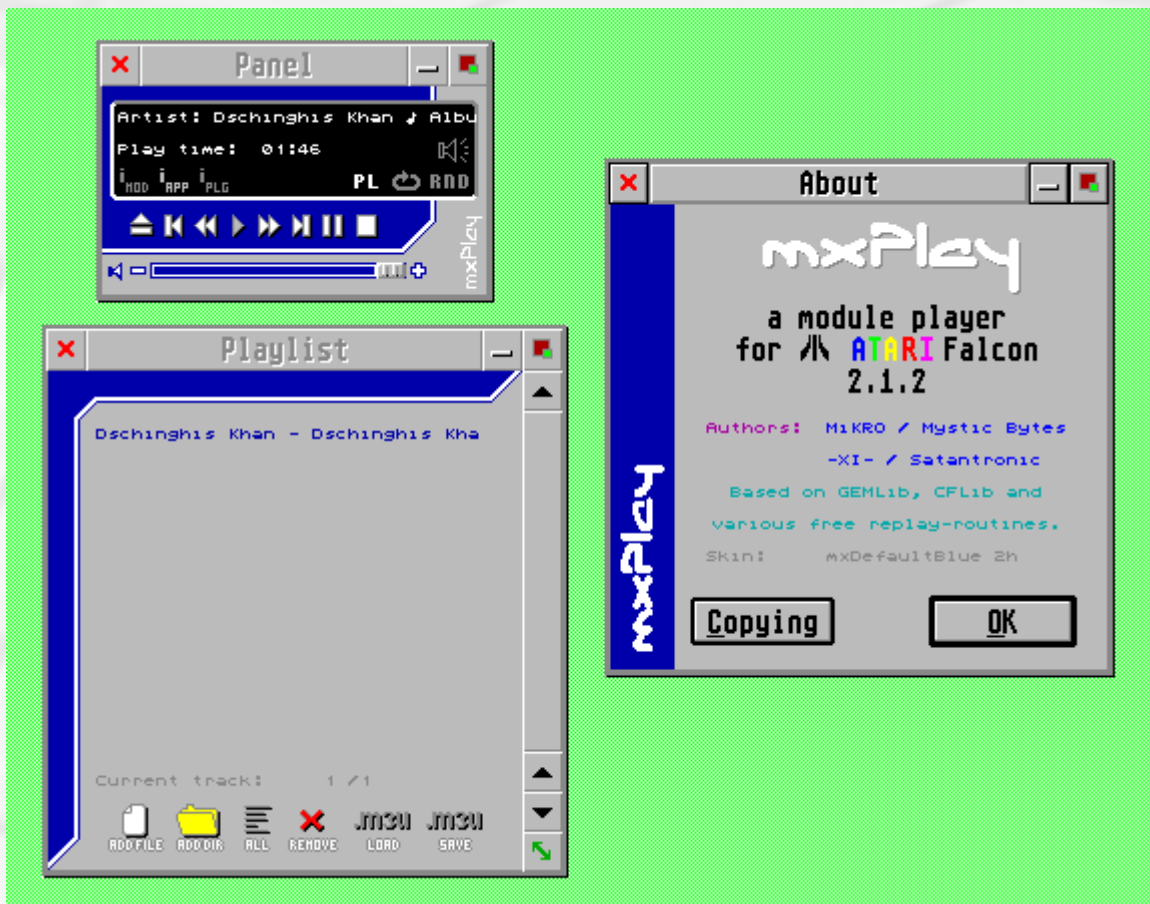
Audio  
and video  
player  
  
by  
Didier  
Méquignon



# mxPlay



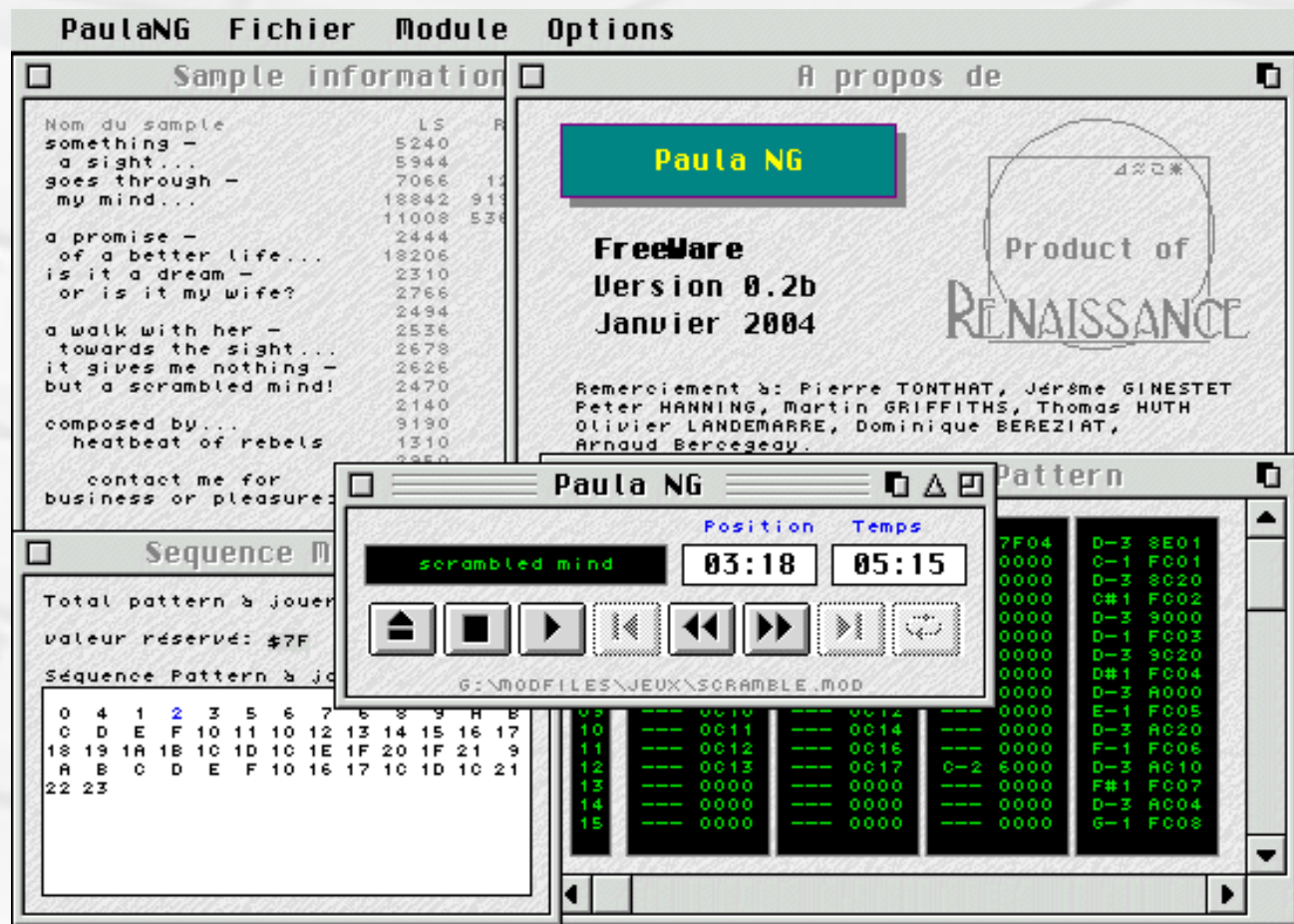
Audio player  
by  
Miro Kropáček  
and -XI-





# PaulaNG

MOD player  
by Daroou /  
Renaissance  
uses the library  
MOD.LDG



# PmDoom

Doom port  
for SDL

by  
Patrice  
Mandin



# **My own recompilation of some GNU/Linux packages (and more)**

arc arj bash bison bzip2 coreutils ctris dhcp diffutils  
dosbox e2fsprogs file findutils flex freemint fvdi gawk  
gdb grep groff gzip hatari hypview iperf less lha make  
man microemacs myman nano ncompress ncurses  
net-tools netkit-ftp nfs nfs-server openssh patch  
ping pmdoom portmap povray qed samba sed  
Sharity-Light strace tar tofrodos toswin2 unrar unzip  
util-linux vim wget xz zip zoo

# Other free C compilers

- **AHCC** by Henk Robbers  
compatible with famous Pure C
- **vasm** by Frank Wille  
**vbcc** by Volker Barthelmann
- **GCC 7 Brown Edition**  
by The Brown Duo
- **GCC 7** by Thorsten Otto  
updated fork of my cross-tools, and more



**And many, many other software...**

Even if Atari has abandoned  
its computers in 1993,  
they are still alive and kicking  
thanks to **the community**  
and **Free Software**.

# Where to start ?

Central starting point :

[freemint.github.io](https://freemint.github.io)

# And the story continues

- 2007 was the starting point of my public contributions
- GCC 4.x patches and cross-compiler binaries for Cygwin gave a **new impulse** to the community
- Other projects appeared, I contributed to some.

# Other cross-tools binaries 1/2

- Few people enjoy Windows and Cygwin, they asked for binaries on more platforms.
- I created Debian packages, and provided Ubuntu binaries. First in my own repository, then on Ubuntu PPA.





# Other cross-tools binaries 2/2

- Keith Scroggins and Miro Kropáček have compiled native GCC 4.x for MiNT. Community was very happy, as lots of people prefer working natively.
- Other binaries were contributed:
  - Dan Horák for Fedora/RHEL GNU/Linux
  - Philipp Donzé for MacOS X
  - Benjamin Gérard for Cygwin 64-bit

# GitHub



- Sources were originally stored in CVS or Subversion, on SourceForge or AtariForge.
- Nowadays, most projects have moved to GitHub.  
Organizations:  
ARAnyM, EmuTOS, FreeMiNT, FireBee
- Sources and **full history** are provided for MiNT software, as well as binutils, GDB, and GCC patches.

# Travis CI 1/2

- In January 2017, Miro Kropáček used Travis CI continuous integration service to **automatically build** all the FreeMiNT kernel components on **each commit**.
- Result is deployed to JFrog Bintray and easily available on the FreeMiNT Project website.



**JFrog Bintray**

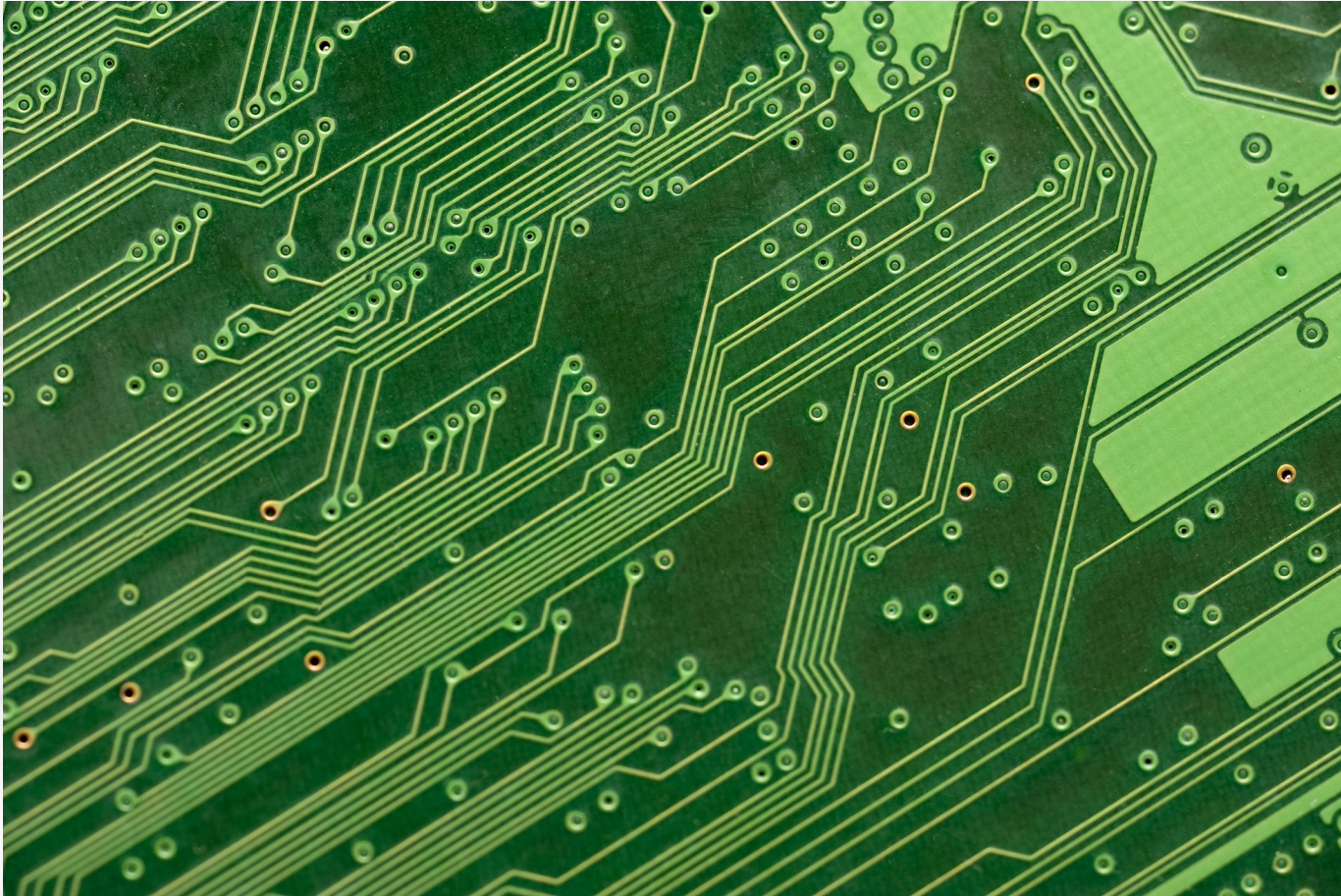
# Travis CI 2/2

- I used the same technique for EmuTOS. On each commit, binary snapshots are automatically built by Travis CI and deployed to SourceForge.
- I also tried similar technique for the binutils/GCC cross-tools. Whenever a new patch is pushed, all the 56 Ubuntu PPA binaries are rebuilt. Still experimental, but useful.





# Hardware projects!



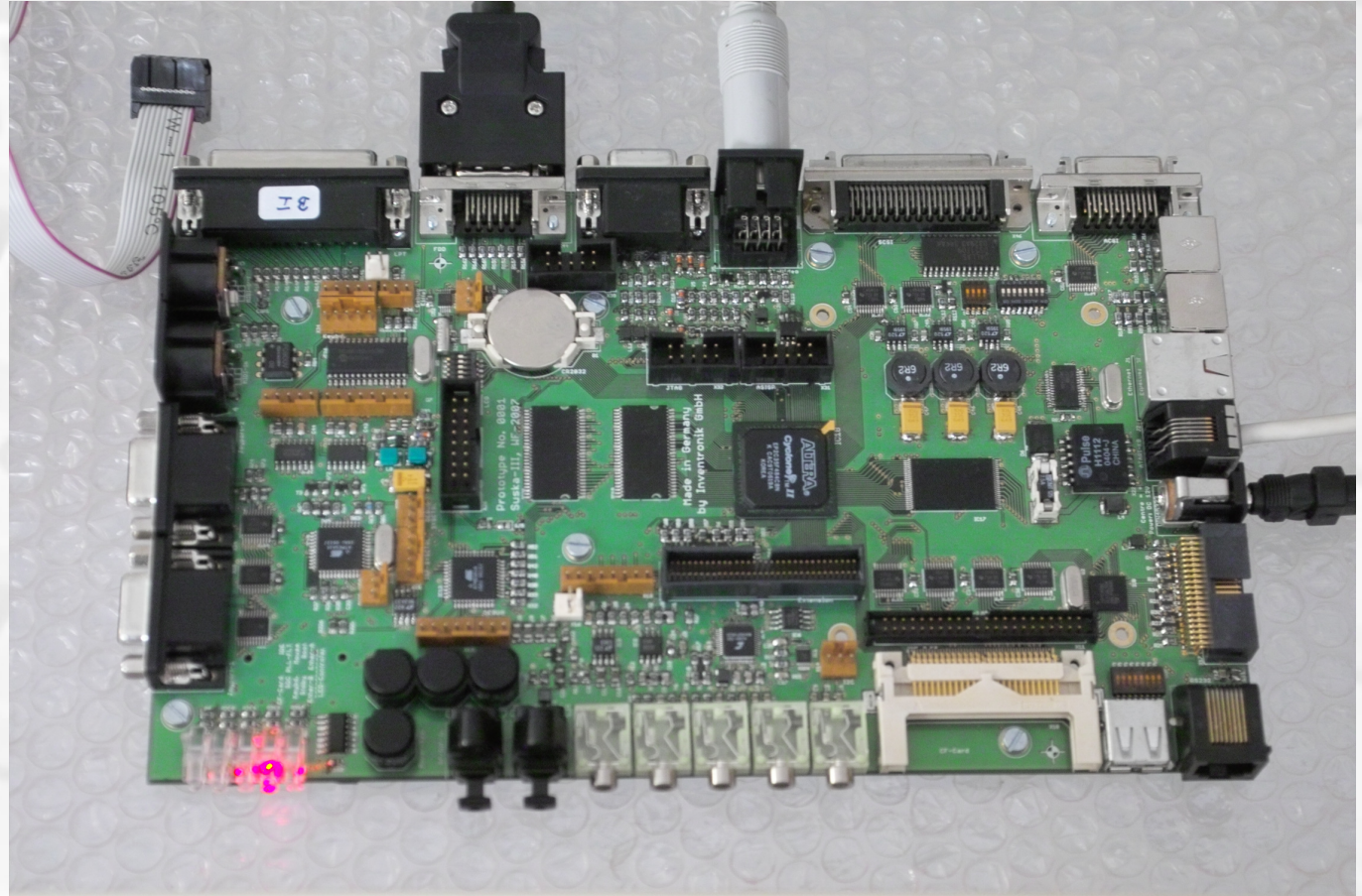




# Suska

Suska board  
by Wolfgang  
Förster

Full Atari ST  
in an FPGA





# FireBee

by the  
ACP team

Atari  
Coldfire  
Project



# FireBee

- Designed by the ACP team:  
Atari Coldfire Project
- Overall specification:  
Atari **Falcon** compatible computer  
**\*but\*** with a **ColdFire CPU @ 264 MHz**  
and many extensions
- Manufactured by:  
Medusa Computer Systems



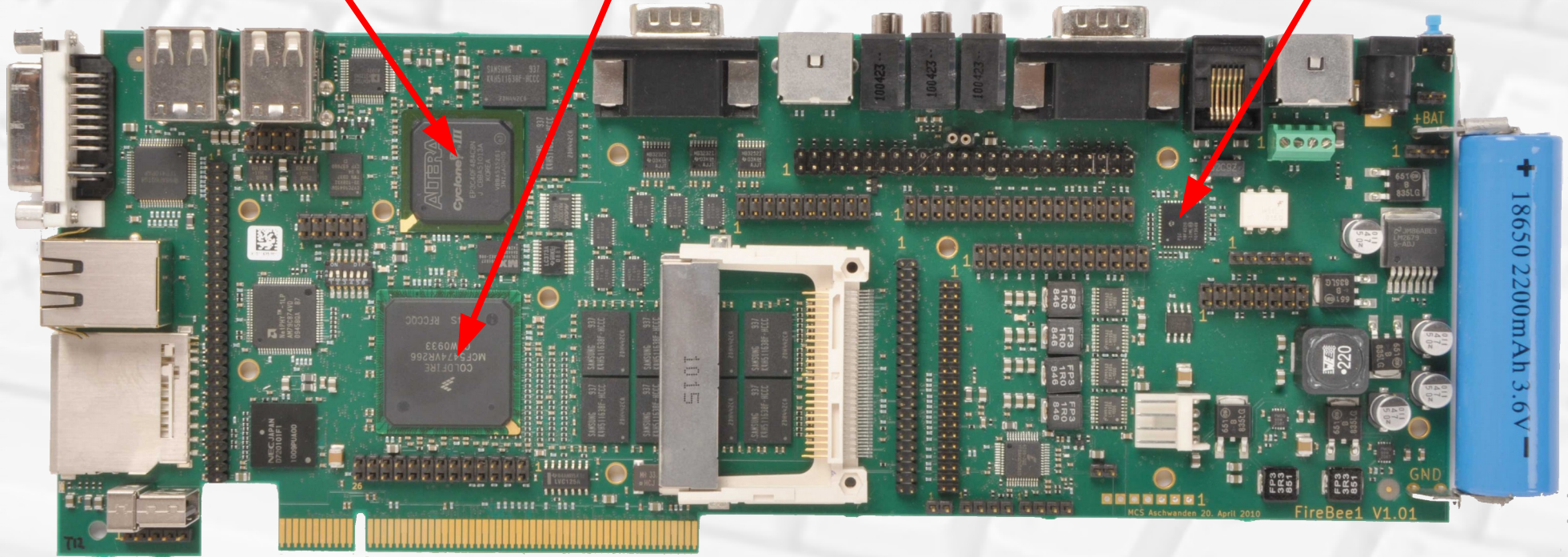


# FireBee

**FPGA**

**ColdFire**

**PIC**



# FireBee



- **ColdFire V4e**: main CPU
- FPGA: Atari hardware emulation
- PIC: auxiliary tasks
- And many I/O ports
- **Open hardware**: plans available
- See all details on [firebee.org](http://firebee.org)

# ColdFire



- Successor of 68000 family, but incompatible due to many missing instructions
- Microcontroller with many embedded features: timers, Ethernet, PCI...
- Faster (up to 266 MHz, or more)
- Mainly used in embedded systems

# FireBee

- Hardware design by Fredy Aschwanden and Wolfgang Förster
- Basically:
  - Suska FPGA core
  - Modified to emulate Falcon hardware
  - Without 68000 FPGA (use ColdFire)



# FireBee Operating Systems



- **EmuTOS** for ColdFire  
100% ColdFire native  
But no 68000 emulation
- **FireTOS**  
Partial 68060 emulation  
Advanced hardware support



# EmuTOS for ColdFire 1/3



- EmuTOS is compatible with Falcon with a 68030 CPU
- The FireBee is a Falcon with a ColdFire CPU
- Solution: “just” add ColdFire CPU support into EmuTOS.

# EmuTOS for ColdFire 2/3



- This was my main task in 2009:
  - Add ColdFire support to the cross-tools
  - Manually **patch all assembler files**
  - Add ColdFire support to all libraries
  - Fight against software and hardware bugs
- But finally worked fine 😊



# EmuTOS for ColdFire 3/3



- Limitations:
  - **ColdFire CPU support only,**  
no 680x0 emulation
  - Only works with programs recompiled  
for ColdFire, 680x0 binaries unsupported
- Was mainly used in early days  
to debug the FireBee hardware
- Also used by purists who like all native

# FireTOS



- By Didier Méquignon
- Main OS for the FireBee
- Runs FreeRTOS behind the scenes
- Partial **68060 emulation** with CF68KLib
- Runs patched TOS 4.04
- Support **extended video modes**
- Support **USB keyboard and mouse**
- Support both 680x0 and ColdFire binaries

# FireBee Compatibility



- Hardware:
  - Partial Falcon emulation:  
lacks DSP, Falcon sound...
  - Still some bugs in emulated hardware
- FireTOS:  
Quite good software compatibility,  
but not perfect.
- EmuTOS:
  - ColdFire binaries only
  - Few support for extended hardware

# Patching for ColdFire

- I continued patching software for ColdFire
  - **FreeMiNT** + drivers
  - XaAES
  - Libraries
- Long, but generally easy
  - C software: just recompilation
  - Assembly: manual patching

# Typical ColdFire patch

Fix missing movem predecrementation

```
#ifdef __mcoldfire__  
    lea    -44(sp), sp  
    movem.l d2-d7/a2-a6, (sp)  
#else  
    movem.l d2-d7/a2-a6, -(sp)  
#endif
```

# EmuTOS on FireBee

FireBee,  
Eiffel adapter,  
PS/2 keyboard  
and mouse  
Falcon VGA  
640x480  
16 colors





# EmuTOS + FreeMiNT on FireBee

FireBee,  
XaAES,  
TeraDesktop,  
bash,  
HypView  
100% ColdFire  
software





# Experimental Hack: 68Kemu

- CPU emulator  
based on **Musashi** 68000 emulator
- Goal: Run 68000 programs on ColdFire OS
- Main idea:
  - Run user program on emulated CPU
  - And **switch to real CPU during OS calls**
- Can help running some 68000 programs on EmuTOS for ColdFire, and FireTOS
- Still issues with callbacks

# Putting all together



- Official FreeMiNT setup for the FireBee by Jo Even Skarstein
- Essential software, ready to be run
- Includes tools for easy graphics and network setup

# Official FreeMiNT setup for the FireBee

FireBee,  
FireTOS,  
1280x960  
32-bit

Thing Desktop  
zView  
NetSurf  
HypView





# Exotic hardware!



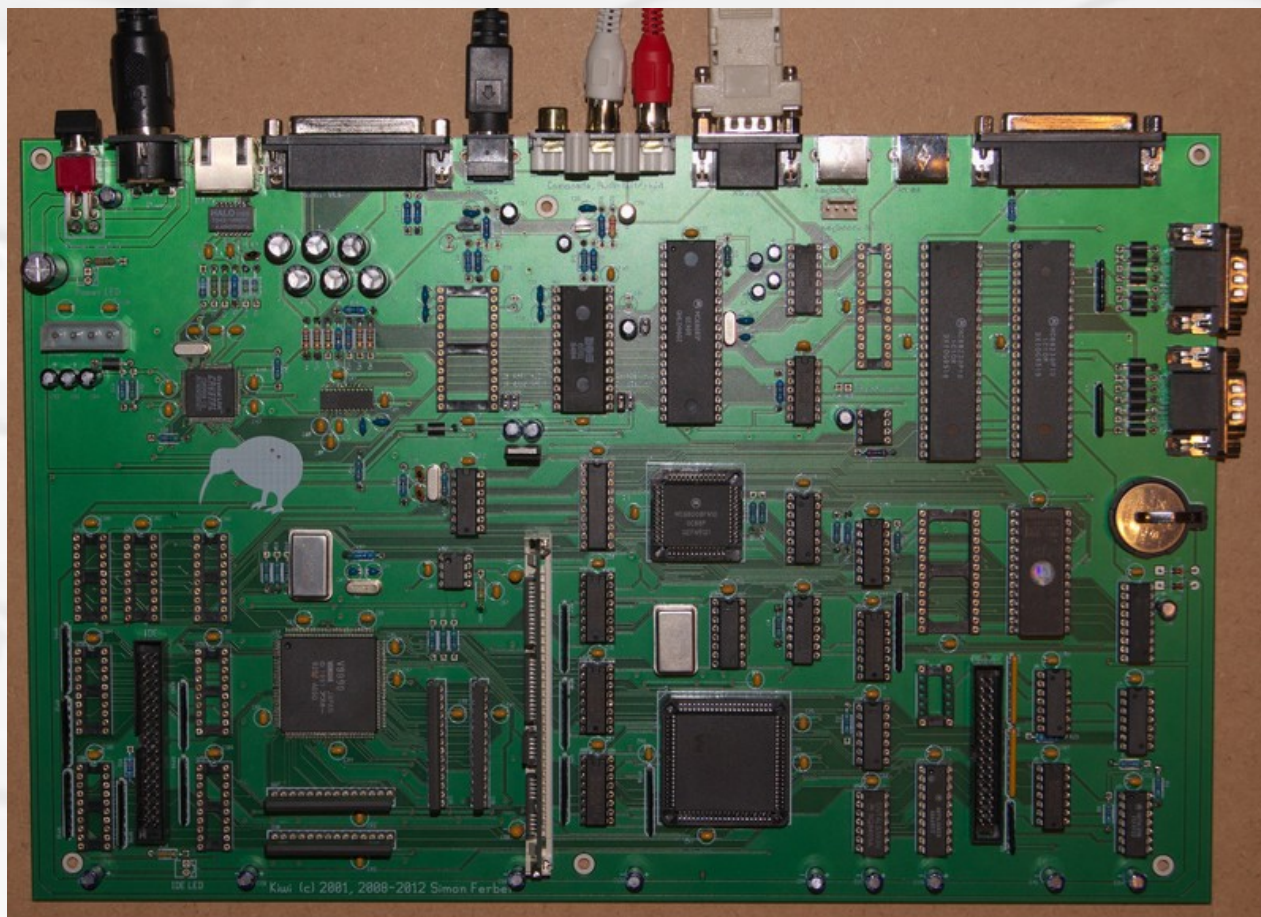


# Kiwi board

Kiwi board  
by Simon  
Ferber

68008-based  
computer

Can run  
EmuTOS





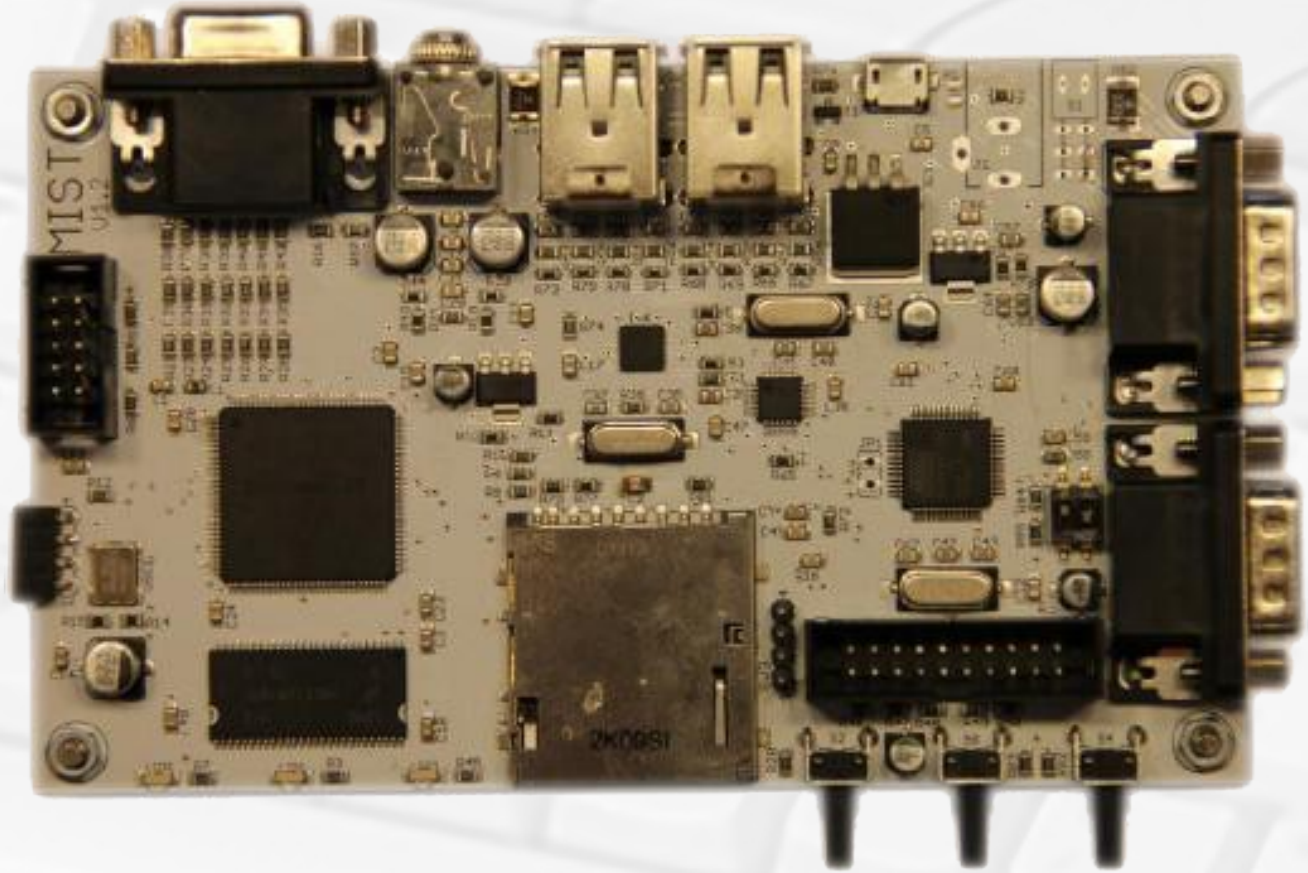
# *MIST*

by Till  
Harbaum

FPGA-based

**\*Many\*** cores  
to emulate  
old machines:  
Atari ST,  
Amiga...

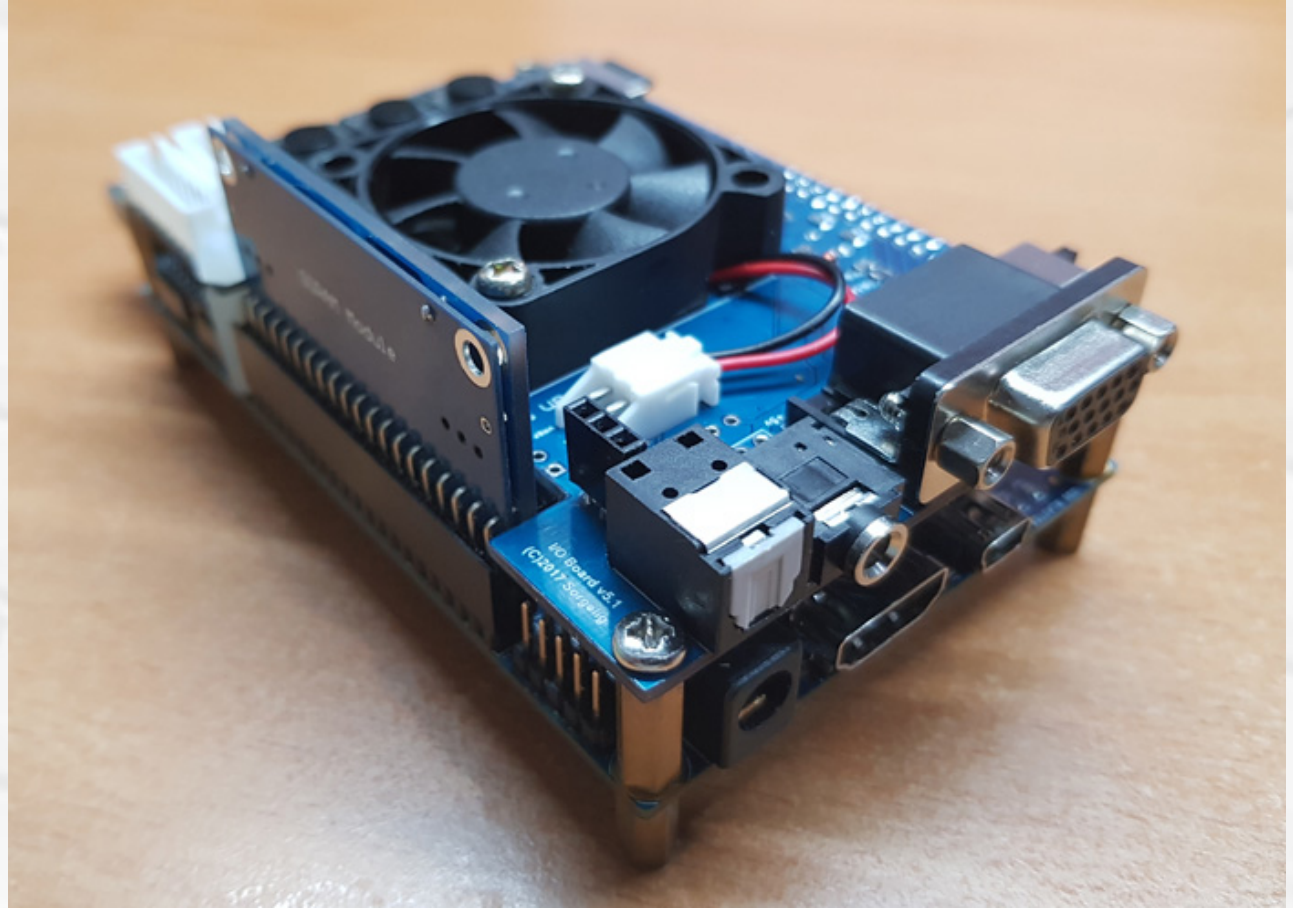
## MiST board



# MiSTer board

by Alexey  
Melnikov

Clone of **MiST**  
based on  
**Terasic**  
**DE10-nano**  
board

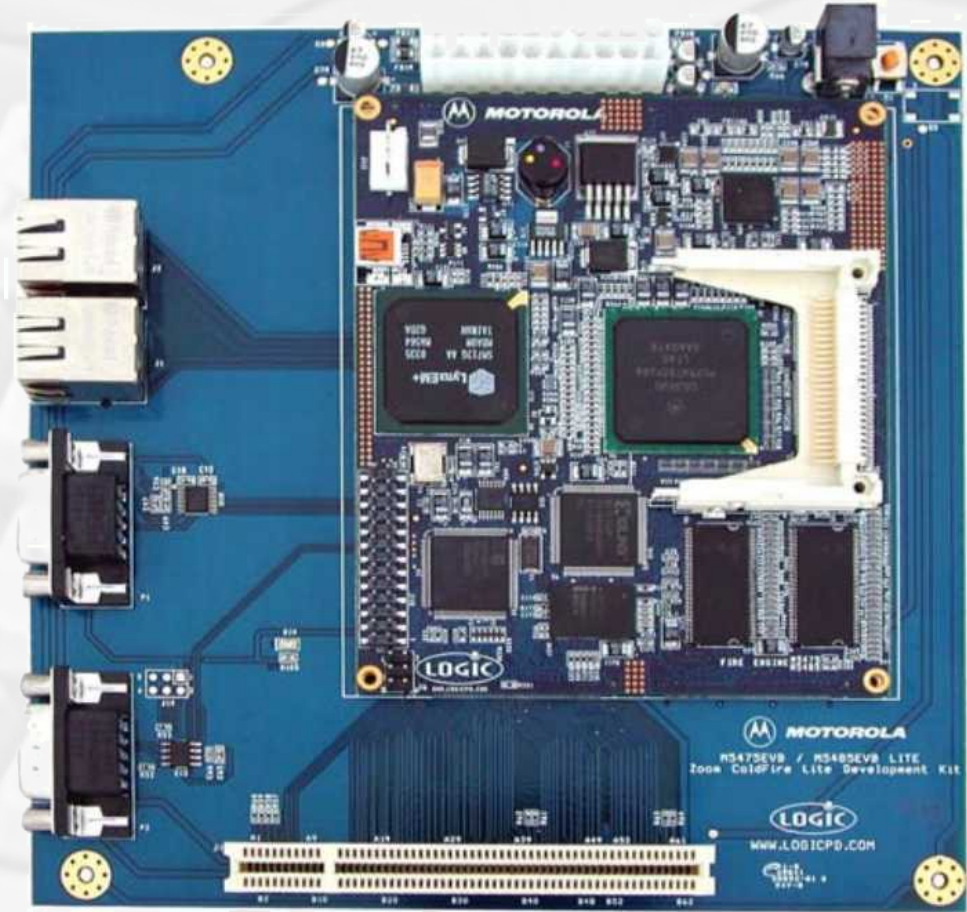




# ColdFire Evaluation Boards

Can run  
**EmuTOS for ColdFire**  
and FreeMiNT  
in **text mode**  
through RS-232  
terminal

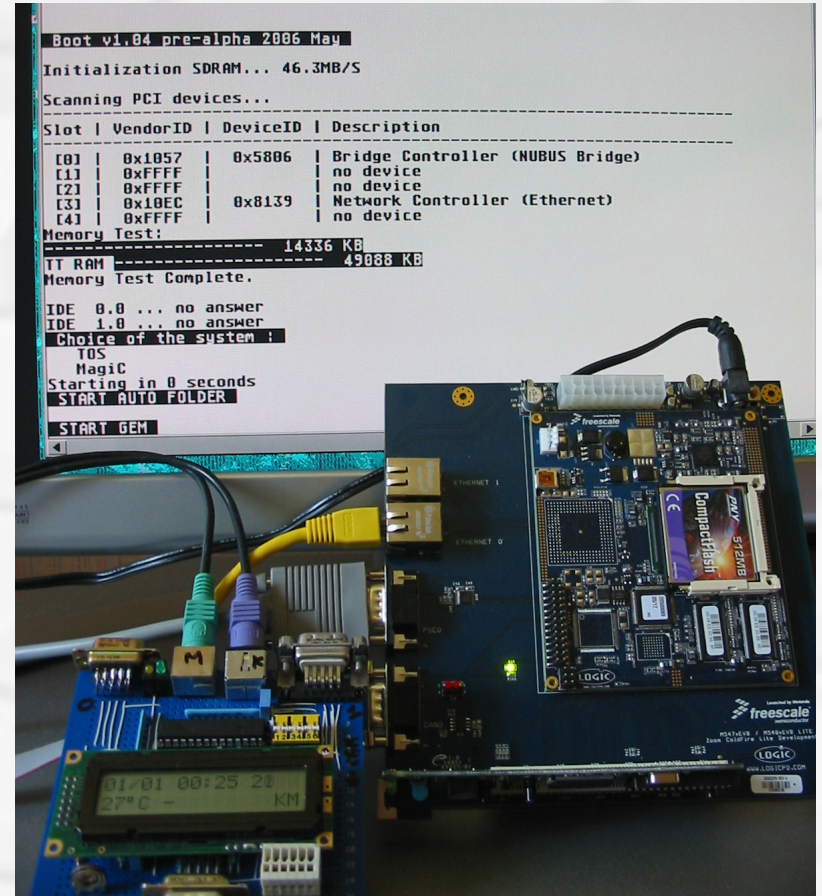
Was used to debug  
EmuTOS for ColdFire  
before FireBee availability



# FireTOS origins

Before the FireBee,  
Didier Méquignon  
used ColdFire  
Evaluation Boards  
to create FireTOS  
and debug the CTPCI add-on  
for Falcon / CT60

With accelerated support  
of **ATI Radeon** PCI cards!



# EmuTOS in terminal

Can also run  
FreeMiNT,  
bash,  
SSH server...



```
M5484LITE - KITTY
ColdFire MCF548X on the M5484LITE
Firmware v4a.1a.1d (Built on Dec 6 2004 11:53:07)
Copyright 1995-2004 Freescale Semiconductor, Inc.

Enter 'help' for help.

dBUG> dn emutos2.srec
Offset: 0x00000000
Downloading S-Record 'emutos2.srec' from 192.168.20.1
S-record download successful!
FTP transfer completed
Read 2800606 bytes (5470 blocks)
dBUG> g

EmuTOS

EmuTOS Version: 0.8.4
CPU type: ColdFire
Machine: M5484LITE
Free ST-RAM: 14228 kB
Screen start: 0x00df8000
GEMDOS drives: AB
Boot time: 1980/00/00 00:00:00

Hold <Control> to skip AUTO/ACC
Hold <Alternate> to skip HDD
Press 'C' to run an early console
Press any key to continue booting

EmuCON - Compiled on 16/07/09
Type HELP for a list of commands.

a: hwc.f.tos
Hello, ColdFire World!
Compiled Jun 15 2009 23:30:22

a: █
```

# Many challenges 1/2

- Support for **new CPU**:  
ColdFire V4e
- Support for **non-Atari hardware**:  
ability to run without legacy hardware
- Support for **foreign hardware**:  
implement BIOS with new low-level drivers

# Many challenges 2/2

- **FreeMiNT** for non-Atari hardware
  - Actually, very few hardware dependencies
  - Mainly uses the underlying BIOS for all I/O (block and character devices)
  - Key to success is reliable support from underlying (Emu/Fire)**TOS**



# BaS\_gcc: alternate firmware

- By Markus Fröschle
- **Alternate bootstrap** for the FireBee and ColdFire Evaluation Boards
- Provides **network access** to FreeMiNT, combined to FEC driver.
- Can be flashed with EmuTOS to transform a ColdFire Evaluation Board to a **standalone** Atari ColdFire machine

# EmuTOS for Amiga!





# EmuTOS for Amiga

- Not so hard because:
  - EmuTOS for **non-Atari hardware** was already done for ColdFire Evaluation Boards
  - Amiga has a standard **68000 CPU**
  - Amiga 1-plane interlaced video mode is compatible with **ST-High** mode
  - Just a few BIOS routines to implement

# Reuse AROS routines?



- Tried to reuse some routines from AROS: floppy driver, AUTOCONFIG
- Worked fine
- But **incompatible open-source licenses**
  - EmuTOS uses GPL
  - AROS uses APL
- Binary redistribution is not possible
- I slowly replace AROS routines by writing new GPL ones

# EmuTOS for Amiga: compatibility

- Requirement for Atari programs:
  - Do not access hardware directly, **use OS calls** instead
  - Support monochrome video mode
- The above requirements:
  - Exclude almost all games
  - But allow most utilities



# Vampire V2 Apollo 68080

Supported by  
EmuTOS  
for Amiga



# Amiga: Vampire V2 accelerators

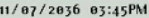
- Based on **FPGA**
- Fast **Apollo 68080** CPU
- HDMI output (SAGA chipset)
- Supported by **EmuTOS for Amiga**
- Maybe some day on Atari hardware?

# **fVDI driver for SAGA**

- Remember: VDI is TOS graphics layer
- fVDI is **Free Software** VDI replacement
- I wrote an **fVDI driver** for SAGA
- This allows EmuTOS for Amiga to use Vampire **HDMI output** with **extended color video modes**



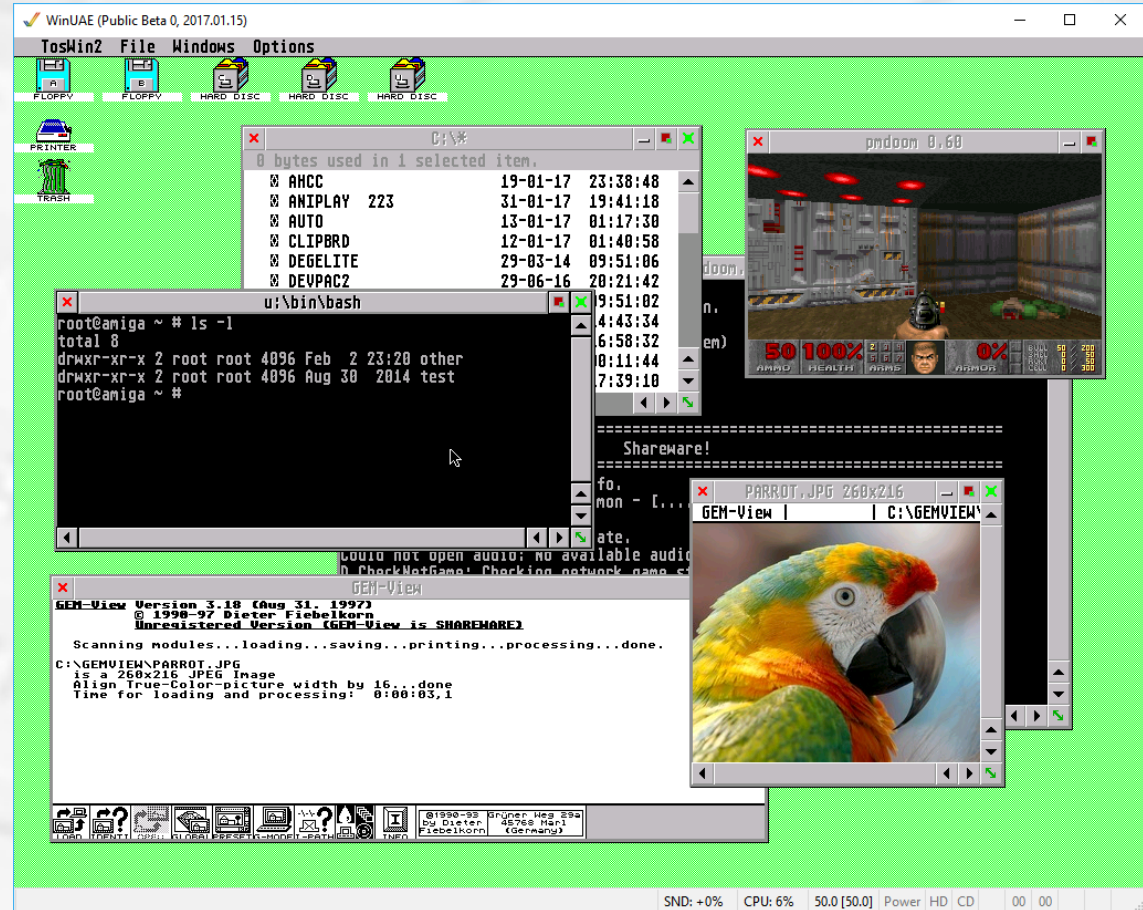
Full  
FreeMiNT  
distribution  
for  
Amiga +  
Vampire  
By Stefan  
Niestegge





# fVDI driver for WinUAE

This is  
an **Amiga** emulator  
running  
EmuTOS ROM,  
fVDI driver  
for extended  
RTG video modes,  
and standard  
FreeMiNT binaries 🤪



# Let's Free Old Software!

- Sometimes, after people's requests, or spontaneously, old companies agree to Free their old software:
  - **Thing** desktop by Arno Welzel and Thomas Binder
  - **Diamond Edge** and **Diamond Back** by Anodyne Software
  - **Geneva and NeoDesk** by Gribnif Software
  - **AtariX** (successor of MagicMacX)
- **Kudos to all of you!**  
**This is the only way to keep software alive.**

# Conclusion

- Atari has unofficially abandoned TOS in 1993
- But the **community** has continued, and still continues, to develop TOS-compatible systems far beyond their original scope
- This has only been possible thanks to **Free Software**
- The story **will continue!**

# My main contributions

- GCC 4 and Atari cross-tools
- EmuTOS for ColdFire
- EmuTOS for Amiga
- FreeMiNT for non-Atari hardware
- fVDI driver for WinUAE and Vampire
- Many bugfixes everywhere

# Join the community

- Atari-Forum
- MiNT Mailing List
- EmuTOS Mailing List
- Amiga Apollo Forum

# Want more?

Subscribe to my new YouTube channel:

**V**  
retro  
computing





Special Thanks  
to Johan Thelin  
for foss-north organization  
  
and all the Atari community

foss-north.se // 2018-04