

ATARI ST

History of The **OS**

Meetup #2 – Histoire d'O(S) du CP/M à aujourd'hui

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A little history of the ATARI ST

Jack Tramiel - the ousted founder of Commodore - secured funding to buy Atari's consumer division from Warner and acquired it in July **1984** with the intent of producing a new computer. Many engineers and executives from Commodore followed Tramiel to the new Atari Corporation.

In **1985** Atari Corporation introduced its new 16-bit computer system called the **520ST**, the successor to the Atari 8-bit family computers at the Consumer Electronics Show in January 1985.



"**ST**" means Sixteen-Thirtytwo, because of the MC68000 Motorola CPU has 16-bit data bus and 32-bit internals.

Atari licensed GEM from Digital Research which was also used on some PCs and the Atari ST was the first personal computer with a full color graphical user interface.

Atari ST computers run GEM on top of the TOS much as early versions of Windows ran on top of MS-DOS. Atari developed TOS as a fast, DOS-like environment with a hierarchical file system.

Hardware Specifications

PROCESSOR Motorola 68000 16/32bit @ 8 MHz. 16-bit data bus/32-bit internal/24-bit address bus

COPROCESSORS MFP 68901 for interrupt handling, Shifter for the video, GLUE and MMU for the memory, YM-2149 for the

- sound
- RAM 512kb (1mb for the 1040ST models)
- SOUND Yamaha YM2149F with 3 voices square wave plus 1 voice white noise mono Programmable Sound Generator
- **DISK DRIVE** Single-sided 3½ inch floppy disk drive with 360kb of capacity 1040ST had double-sided drives which had a capacity of 720kb
 - **DISPLAY** 60 Hz NTSC, 50 Hz PAL, 71.2 Hz monochrome
- **RESOLUTION** Low Resolution 320×200 (16 colors) with a palette of 512 colors Medium resolution - 640×200 (4 colors) High resolution – Mono - 640×400
 - PORTS TV out (on ST-M and ST-FM models, NTSC or PAL standard RF modulated) RS-232 serial, Centronics parallel (printer) Monitor (RGB or Composite Video colour and mono, 13-pin DIN) Extra Disk drive port (15-pin DIN) DMA port (ACSI port, Atari Computer System Interface) for hard disks and Atari Laser Printer Joystick and Mouse ports (Atari standard) MIDI "IN" and "OUT/THRU"



The Operating System

The TOS is stored in onboard ROM chips, though early versions of the Atari ST came with TOS on floppy disks

About The Operating System

The operating system in the Atari ST is called TOS which simply means "The Operating System" - and not the "Tramiel Operating System" ^(C)

The Atari ST has an extremely complex operating system consisting of several groups of routines that comprise several different levels of interaction with the machine

It combines the GEM GUI and the underlying GEMDOS, a DOS-like operating system by Digital Research which originally developed GEM as a graphic layer on top of MS-DOS

Because it's stored on ROM chips it boots up instantly!

TOS - The Operating System

The ST's OS can be divided into three large groups of routines:

- **BIOS**, **XBIOS** and **Line A** libraries. These libraries control machine dependent functions (like controlling the peripherals) and basic I/O.
- **GEM** (Graphics Environment Manager) contains two libraries, the **AES** and **VDI** routines. GEM is responsible for the windowing environment and the desktop that makes using the ST more intuitive. The AES is concerned mostly with windows and dialogs, things that the user interacts with. The VDI routines handle complex text display and high level graphics manipulations.
- GEMDOS (GEM Disk Operating System) are the machine independent routines for handling files and tasks (programs) and doing "high" level I/O.

Both TOS and GEM are stored entirely in the system's ROM

TOS - The Operating System























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GEM, a little green Desktop



GEM - Graphics Environment Manager

The Graphics Environment Manager is a machine independent with set of routines that enable the programmer to use windows, dialogs, the mouse, buttons, and sliders to interface with an end user.



GEM also allows you to present complex graphics and output them to a number of different devices. It is built so that these features can be defined, accessed, and used with a relatively small number of routines. It also allows limited multitasking through desk accessories.

GEM - Graphics Environment Manager

The desktop uses icons to represent devices and files and has windows and dialog boxes. The standard desktop has a trashcan and two floppy disk icons. On the top part is a drop down menu. It changes its contents depending on the application (much like on a Macintosh), though applications are not required to even use the menu in which case it is removed.

TOS can execute a variety of different filetypes identified by their extensions:

- **.ACC** Desktop accessory (loaded automatically)
- .PRG and .APP Executable program (often GEM programs)
- .TOS Programs that only uses GEMDOS and not the GEM system to work.
- .TTP TOS Takes Parameters. Opens up a dialog box in which you can add arguments for the program.

If the floppy is inserted into the drive when the computer boots, it will bypass the GEM desktop and boot the program contained in an AUTO folder. This is used by many demos and most games [©]

Atari ST - Ready to use?



System compliance and emulations





GEMDOS which makes easy the transition from the PC to the ST and is compatible with the DOS calls of the PC (int 21h)

Evolution of the Atari ST OS



Version	Name	Date	Support	GEMDOS	AES	Model
1.00	Mushroom	20.06.1985	RAM	0.13	1.01	ST
1.00	Old TOS	06.02.1986	ROM	0.13	1.20	ST/STF
1.02	Blitter	22.04.1987	ROM	0.13	1.40	MEGA/STF
1.04	Rainbow TOS	22.02.1989	ROM	0.15	1.40	MEGA/STF/STACY
1.06	STE TOS	19.06.1989	ROM	0.15	1.40	STE
1.62	STE TOS	11.01.1990	ROM	0.17	1.40	STE

Quizz: which version I need?



TOS – Pros and Cons

- Stable and not memory hungry
- The System resides in ROM and It doesn't utilize the system RAM
- It doesn't support multitasking
- Memory can be upgraded to 12mb
- The system switches the CPU time between those seven tasks if they interact with the GEM (parallel architecture)
- The System and the keyboard supports 12 languages
- It doesn't support big logical drives (need to make several partitions)
- Atari TOS is based on GEMDOS which uses a modified FAT12 on floppies (360ko to 900ko) or FAT16 on hard disks file system (partition is about 512 MB)
- GEMDOS disc file systems can be read on PC using DOS or Windows



Atari TOS versions

Official TOS versions for Atari computers:

- 1985-1990: TOS 1.x (ST / STf / Mega ST / STe)
- 1990-1991: TOS 2.x (Mega STe)
- 1990-1991: TOS 3.x (TT)
- 1992-1993: TOS 4.x (Falcon)



Always fully contained in ROM
 New versions mainly add support for new hardware
 A few minor evolutions (XBIOS, AES, Desktop)



Atari TT (1990), TOS 3.06

Bureau Fichier Visualisation Options <u>i)</u> C:\DEVPACJ\#.# 471717 octets utilisés par 39 objets C:\AHCC*.* 1258814 octets utilisés par 22 #11.0_FT.1 0 8

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• Up to 1280x960 in monochrome

Also supports
 640x480 16 colors
 320x480 256 colors



Atari Falcon 030 (1992), TOS 4.04



CORBEILLE

- 640x480, VGA
- 2, 4, 16 or 256 colors
- Also supports 16-bit High-Color in 320x240



TOS for Atari clones

- <u>Medusa Computer Systems</u>
 T40 (1995), Hades 040/060 (1996)
 Modified TOS 3.06
- <u>MILAN-Computersystems GbR</u> Milan 040/060 (1998)
 Modified TOS 4.04 (4.05 – 4.08)





Those companies got contracts with Atari to redistribute modified TOS

Patched TOS binaries



- <u>CT60 TOS by Didier Méquignon</u> (2001-2011)
 Falcon TOS 4.04 patched to support <u>CT60/CT63/CTPCI</u> accelerator boards: 68060 CPU, FastRAM, extension port.
 Even more modified as <u>FireTOS</u> for the <u>FireBee</u> and its ColdFire processor.
- <u>TOS 1.04 & 1.62 updates by PP</u> (2018) Bugfixes, improved FAT support for bigger partitions, virtual floppy support, and much more.



Alternate OS: <u>Geneva</u> (1993) by Gribnif Software



 Cooperative multitasking

 Best used with NeoDesk desktop

• <u>Open-sourced</u> in 2018

Alternate OS: <u>MagiC</u> (1992) by A. Kromke, S. & W. Behne



 Preemptive multitasking

- New desktop: MAGXDESK
- Also available on <u>Mac</u>, <u>PC</u>
- Successor <u>AtariX</u> open-sourced in 2018

But let's go back in time for the real revolution...

MINT: MINT is Not TOS (1990) by Eric R. Smith

- Preemptive multitasking kernel
- Works on top of TOS
- Device drivers support

- MiNT is Not TOS: MiNT version 0.95 PL 13 Copyright 1990,1991,1992 Eric R. Smith Use this program at your own risk!
- Alternate file system support (MINIX, ext2, FAT32)
- Long File Names support (VFAT)
- Extends the TOS API (GEMDOS) with UNIX-like features
- Includes TCP/IP stack



MiNT: Seen from ROM Desktop



 Unified U: virtual drive as single root

 Contains links to partitions

 UNIX-like pipe, proc, shm directories

MiNTLib: C standard library

#include <stdio.h>

Support for major compilers: Pure C, C68, GCC...

- Provide POSIX API on top of TOS/MiNT
- Translate POSIX calls at runtime
 To MiNT system calls if available
 Otherwise to TOS system calls
- Binaries can automatically take advantage of MiNT features at runtime, when available.
- Most GNU / Linux software can be built out of the box

MiNT + MiNTLib: POSIX environment

```
/c/vincent/c/hello>echo $BASH_VERSION
1.14.0(1)
 /c/vincent/c/hello>uname -a
          T ? 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
                                                     134 Nov 20 00:06 hello.c
as68 u:\tmp\hello.s u:\tmp\hello.o
rm -f u:\tmp\hello.i
    -f u:\tmp\hello.s
-o hello crt0.o u:\tmp\hello.o u:\usr\lib\libc.a
    -f u:\tmp\hello.o
/c/vincent/c/helln>ll
                                                  134 Nov 20 00:06 hello.c
15336 Nov 20 00:12 hello
                   l root
                                  sys
                   1 root
                                  SYS
-rw-rw-
/c/vincent/c/hello>./hello
Hello, World!
/c/vincent/c/hello>
```

 Translation of paths between DOS-like and UNIX-like

Example: /tmp

= u:\tmp

Old MiNT setup on ST (1995)

Atari MultiTOS (1992)

- 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 or clones

• MiNT kernel was renamed to "MiNT is Now TOS"

Multitasking AES and DESKTOP



Atari MultiTOS (1992)



• MiNT kernel behind the scenes

 Multitasking AES and Desktop

<u>FreeMiNT</u> (2000...)

 Continuation of MiNT kernel, as Free Software • Put into CVS in 2000, then Git in 2017 Actively supported by the community based around the MiNT Mailing List Automatic builds with GitHub, Travis CI and Bintray Shipped with XaAES graphical user interface

XaAES: multitasking AES for FreeMiNT



 FreeMiNT kernel behind the scenes XaAES windowed environment Tera Desktop • All of them: Free Software

SpareMiNT distribution (2000~2010)

- FreeMiNT kernel
- GCC + MiNTLib
- RPM packages (Red Hat)
- Huge efforts to provide a full UNIX-like environment: many, many Free packages, mostly from GNU/Linux.
 Can be installed with EasyMiNT installer



Everything is Free Software... except TOS ROMs?

<u>EmuTOS</u> (2001...)



- New operating system compatible with Atari TOS
- Implemented as Free Software, GPLv2 license
- Based on open-sourced old Digital Research GEM sources
- Does not contain any code from Atari company (still copyrighted)
- Gaps were filled by the EmuTOS development team
- Reimplementation of all layers: BIOS, GEMDOS (BDOS), VDI, AES, Desktop
- Available in many variants: ROM, PRG, floppy, cartridge...
- Supports all Atari computers, all 680x0 CPU, ColdFire CPU, and even non-Atari hardware



All TOS layers are reimplemented as Free Software

Surprisingly similar, isn't it?

History of GEM on PC

- 1984: Digital Research Inc.
- 1991: Novell (bought Digital Research Inc.)
- 1996: Caldera, Inc. (bought DR-DOS from Novell)
- 1998: Caldera Thin Clients, Inc. (subsidiary of Caldera, Inc.)
- 1999: Lineo (new name of Caldera Thin Clients, Inc.)
- 1999: GPL (by Caldera/Lineo)

Full history: <u>Wikipedia</u> Archive (including downloads): <u>GEM Contents</u> And also: <u>John Elliott's GEM pages</u>, <u>FreeGEM</u>, <u>OpenGEM</u>





(abandonware)

actively supported

Emulators + EmuTOS + FreeMiNT

- Modern platform, TOS compatible + UNIX-like
- 100% Free Software
- Standard emulators: <u>Hatari</u> and <u>Steem SSE</u>
- Extended emulator: <u>ARAnyM</u>
 - Improved block device support
 - Access to host filesystem
 - Extended video modes
 - Network bridge
 - OS support through EmuTOS, fVDI and FreeMiNT drivers





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BeeKey / BeePi distribution by Philippe Noble

 GNU/Linux, ARAnyM, FreeMiNT... on bootable USB key for PC, Mac, or Raspberry Pi

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	beta is here !	After many months of trials and errors, thousands of pages read on the net and many		
41	First glance	uscussions, ram giad to infroduce you beekey.		
	Site Open	It's a self-contained Aranyon 1.02 + EasyAraMint installed on top of Universities Remix		
	What's conving	15.04 (a terminal only distro weighting 300 MB) that boots straight into Aranym from an		
-34" 8	XaAES	USB Key, with a persistent storage up to 4 GB. Total system weights less than 1.2GB.		Zip it!
	gradients			Text Editor
	A5kin	It's a work in progress and it has been tested only on a few Macs (Macbook Pro from		Calculator
-	gradients	2008. and MacPro from 2008) and PC (intel NUC i5 from 2015). It should work on any		Dideo Player
	update ASKin'	different ways to install it and the key will boot only on a PC or a Mac, but not on both		Rudio Player
	13			Vorkspace nanager
	= Softwares		and the second	
	Documents	Video, sound, network are setup automatically and should work out of the box with almost every hardware, except. WiFi, touchpads and 4K or retina screeps which are too	Ateri Vorks	Office >
	05	big to work in native resolution.	Phoenix Manager	Development >
	Sitemap	Re-	Phoenix Designer	Games >
		Boot time is quite short (1min the first time and 30sec after) and you don't feel any	Kandinsku	Setup)
	Navigation	slowdown in the usage, as far as your USB key is USB3. USB2 is slower and the first boot	Vision	Start >
	Applications	will last 5 min, the others 1 min 20 sec. I strongly recommend using an USB3 key.	Snurf	
-	Documents			Shutdown
	05	If you don't care having persistent storage and just want to try it without the possibility		Recent documents
		to save data, a 2GB USB key will be enough. The minimum USB key size recommended if you want persistence is 4 GB U 2 GB for the susters 2 B GB for the persistence) ideally		Control Panel >
		a BGB if you want to have the full 4GB of persistent storage. USB3 keys are generally		Ry documents
		loce or olgger, so you will lose haif of the space with this standard install: we will see later on how to recuperate it with a second partition, but it's a more complicated story.		Search
		Hard drive install has not been tested yet but it should be feasible. Please read, this linkif you want to try the adventure, knowing that it will erase all the data on your hard drive		
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FireBee computer (2011) by the Atari Coldfire Project



FireTOS,
 FreeMiNT,
 XaAES,
 Tera Desktop

NetSurf web browser



Want more?

foss-north 2018 presentation: <u>Atari ST Free Operating Systems</u>

• YouTube channel: <u>Vretrocomputing</u>







