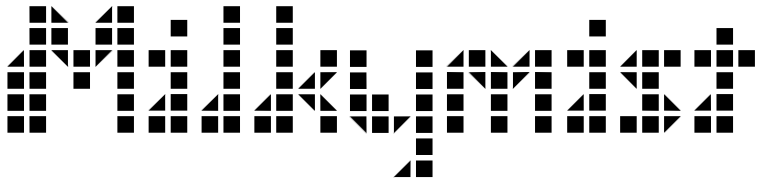


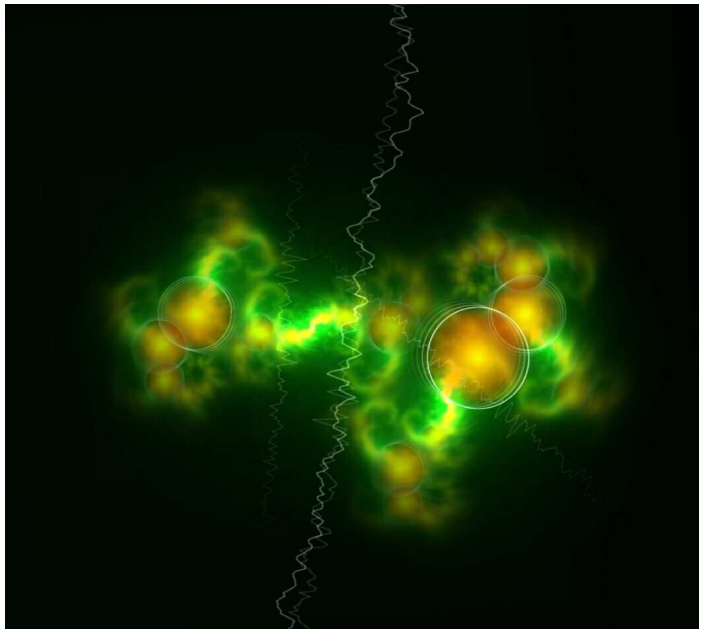
Milkymist™

Open hardware interactive VJ station

Sébastien Bourdeauducq

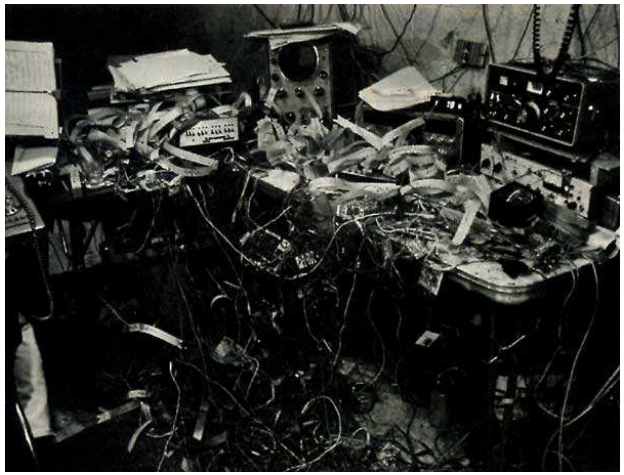
Breizh Entropy Congress – Rennes – April 15-17, 2010

Some background...



- Started VJing in 2005
- Kludgy, ad hoc software inspired by MilkDrop, running on Linux PCs
- Tried to make performances more interactive

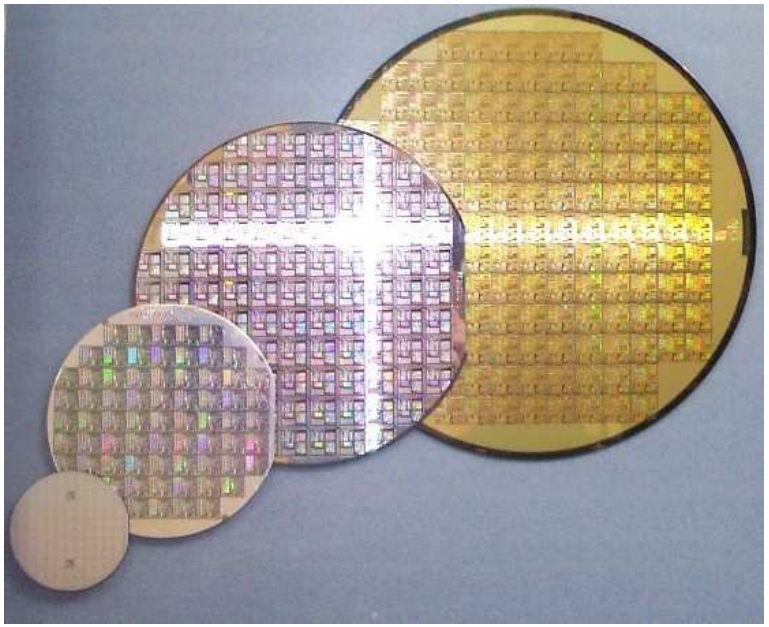
Why Milkymist was born



- PC towers feel heavy when carried around at 5am
- Long boot and setup times
- Power cut = 500 people see your computer rebooting
- Interfaces (MIDI, DMX, video input ...)
  - expensive
  - big mess of wires
  - driver problems at the wrong moment

Embedded would be cool, wouldn't it?

- Do all the VJing with a small box that has everything
- Live seconds after power up
- Technically feasible? Yes, but needs high-performance SoC.
- Open hardware is better...



Part I – The Chip

Open Hardware, SRSLY.

- Open source software is already well known...
- Among many hackers and artists: trend for “open source hardware”
- Famous projects based around open PCB designs: Arduino, Beagleboard, ...
- But all the magic is done by a proprietary chip!
- I want to go further!

The Milkymist chip

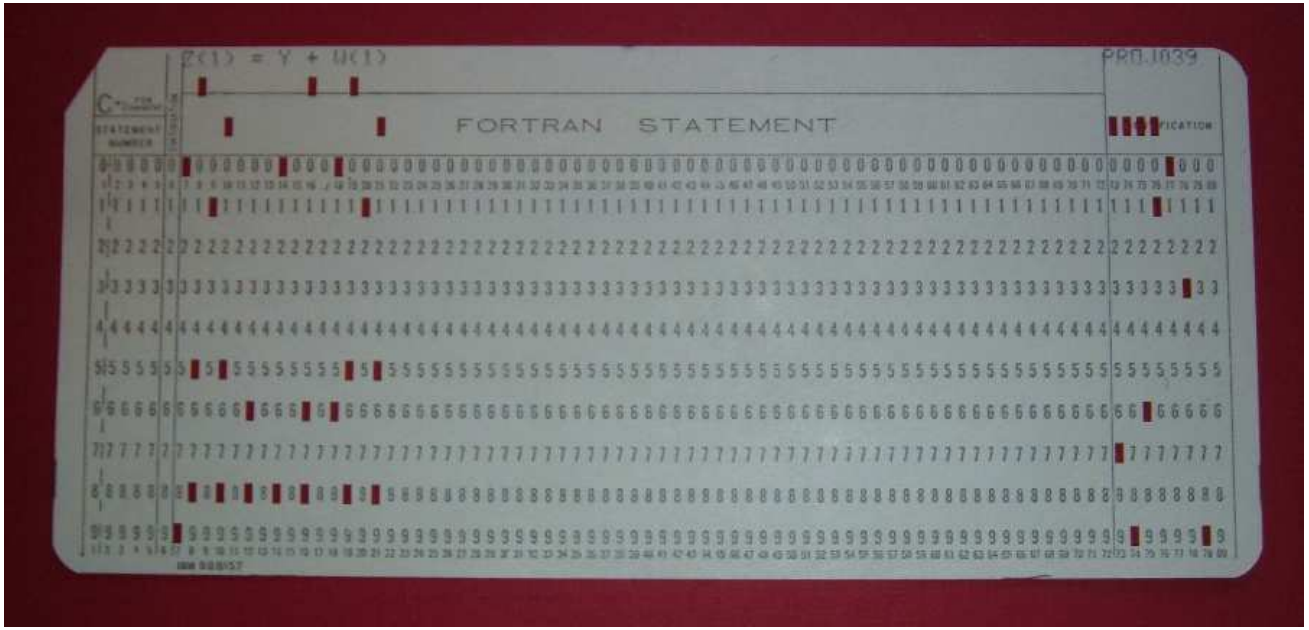
- Milkymist features a custom, free (System-on-)Chip design
  - Freedom, plus:
  - built-in custom interfaces
  - high performance
  - small size
- Works on FPGAs – reconfigurable silicon
  - enables everyone to modify and test the design
- Portable code – small effort to port to all FPGA vendors, or even to make a fully "hard" chip (and yes, we'll do it)

What makes it specific?

- The Milkymist System-on-Chip (SoC) contains a general-purpose Linux-capable computer.

VJ-friendly on-chip features

- Video output (VGA)
- Video input (PAL/SECAM/NTSC)
- AC'97 audio
- Control interfaces
  - Ethernet (OpenSoundControl)
  - MIDI
  - DMX512
  - USB
  - IR remote control
  - Generic digital I/O
- Hardware graphics acceleration
  - A small subset of OpenGL, enough for our purposes.



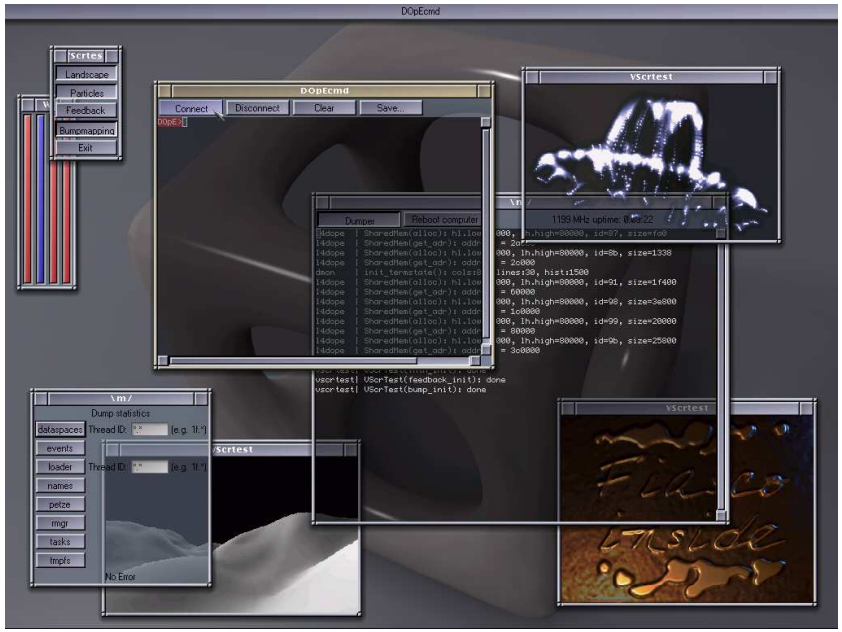
Part II – The Software

It's the software, stupid!

- Well, some people are thinking...
- "phew, VJs ain't gonna program FPGAs!"
- The FPGA is transparent (unless you go looking for it)
  - it will even disappear when we start engraving our own chips
- Only the software defines what the average user sees.
- If you get it right, you can hide any technical complexity.
  - people use Mac OS X on computers more complex than Milkymist, and think it's simple.

Flickernoise, Milkymist's VJ application

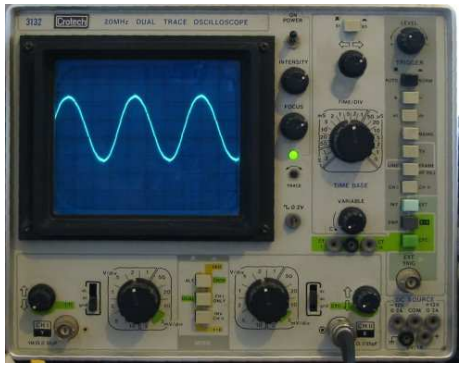
- Not fully developed yet
- Will boot and get ready in seconds
- Using the Genode FX GUI toolkit
- Visual effect renderer inspired by MilkDrop
- GNU GPL licensed



How does the renderer work?

Based on a simple iterative process:

- Draw a waveform based on the music
- Distort the image
- Draw a waveform again...



Demonstration in the second part of the talk!

Extra features

- Borders
- Motion vectors
- Video echo

Upcoming:

- Custom waves and shapes
- User defined pictures
- Blend with video input
- ...

Demonstration in the second part of the talk!

Patch parameters

- Parameters to customize the patch, examples:
  - how the wave is traced: nWaveMode
  - wave color: wave_r, wave_g, wave_b
  - amount of zoom when distorting: zoom
  - displacement when distorting: dx, dy
  - ...

Demonstration in the second part of the talk!

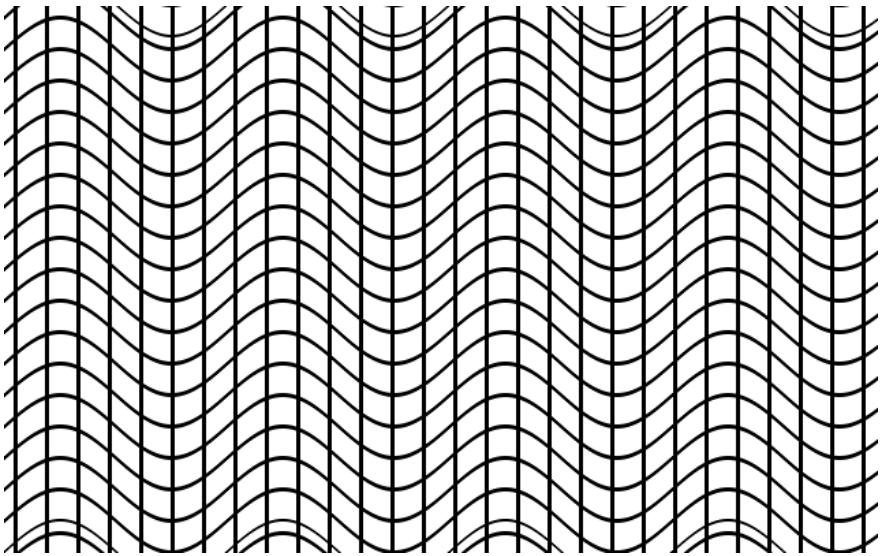
Per-frame equations

- Allow the parameters to change over time
- Examples:
  - per_frame_1=dx=0.1*bass
  - per_frame_2=wave_r=0.3 + 0.1*sin(6.28*time)
  - ...

Demonstration in the second part of the talk!

Per-vertex equations

- Configure the distortion on each control point (vertex)
- Example: per_vertex_1=dy=0.1*sin(40*x)



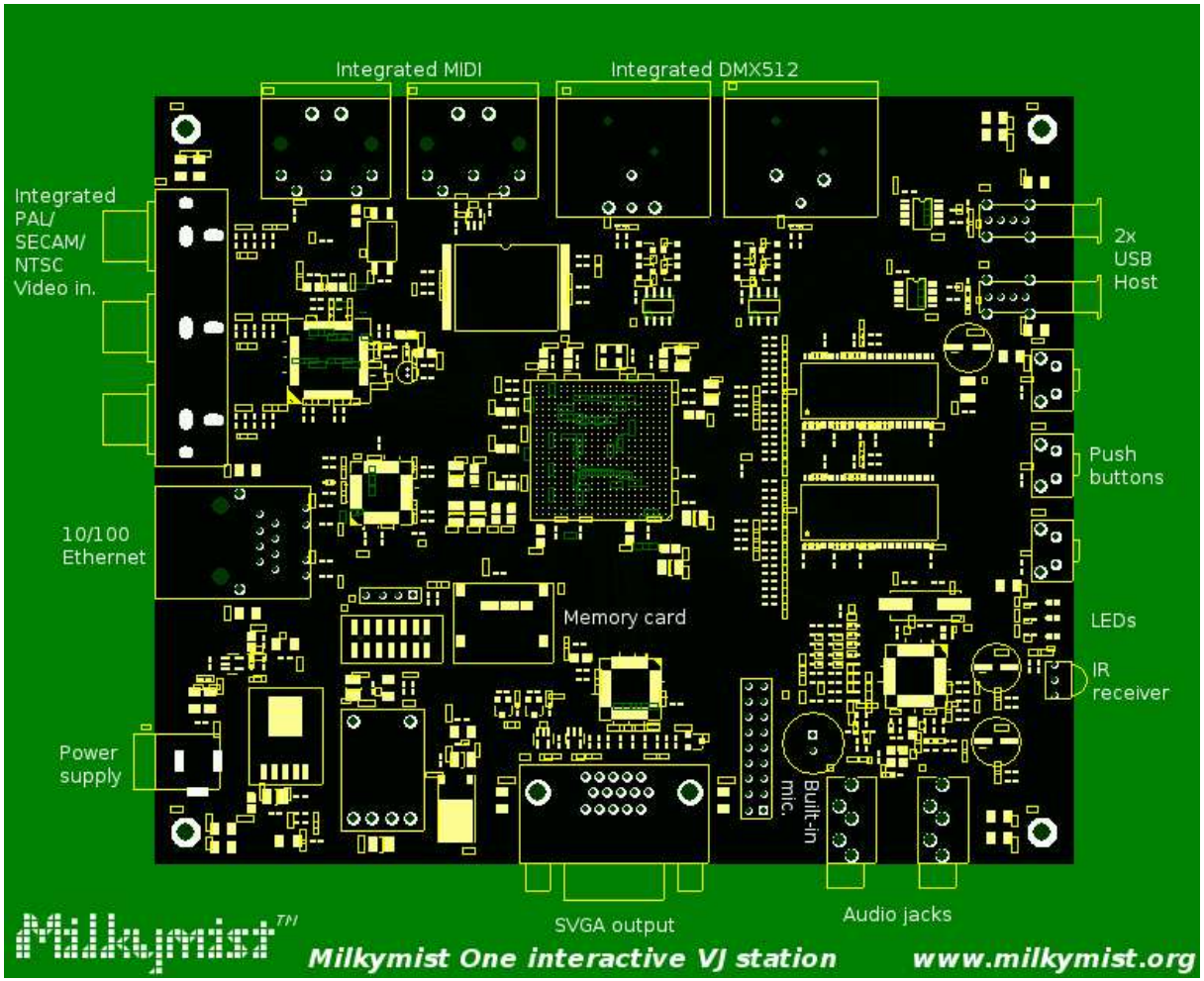
Demonstration in the second part of the talk!

Part III – The Product

The product

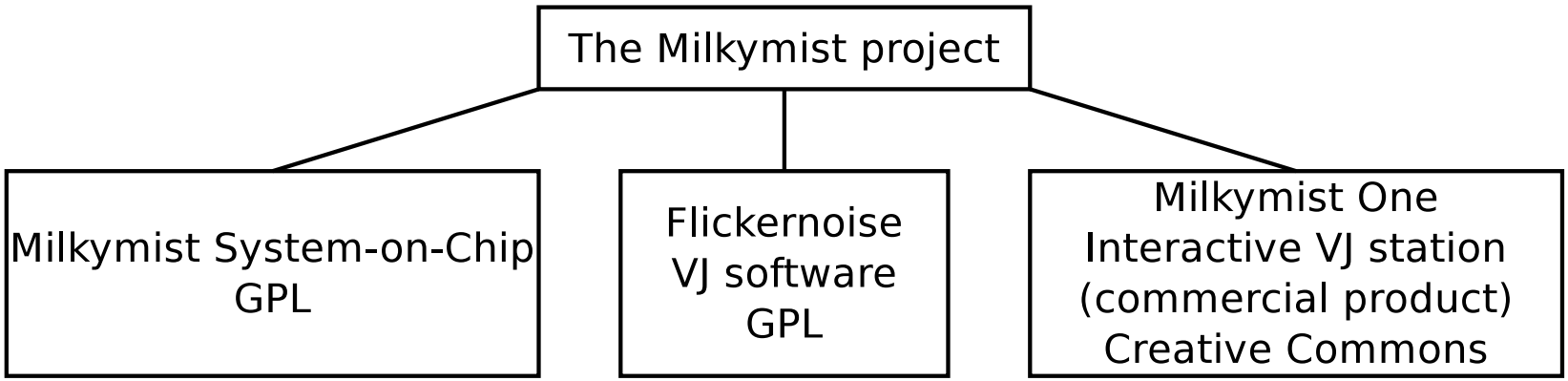
- We want to make a complete, high quality end user product
  - An interactive VJ station, not a FPGA development board!
  - With case and packaging
  - Works out of the box
- Open design as well (like the rest)
- Developed, manufactured and sold in collaboration with Sharism at Work Ltd. (known for Ben Nanonote)

Milkymist One (M1)



Status

- Boards prototypes (for developers) coming in a few weeks
  - right now, software and chip design are tested on an existing FPGA development board (Xilinx ML401)
- We will design and manufacture a case etc.
- No defined list price/release date yet



- Web: `http://www.milkymist.org`
  - documented source code (GPLv3 licensing)
  - mailing list, wiki, blog
- Mail: sebastien.bourdeauducq [AT] lekernel DOT net

Demonstration!