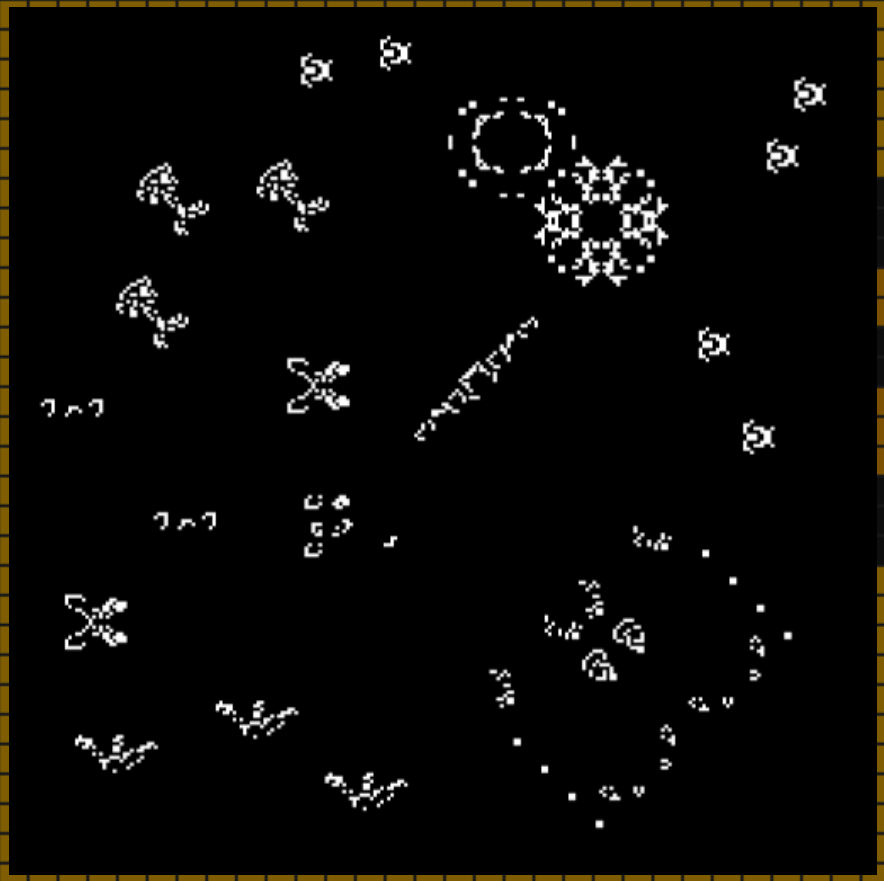
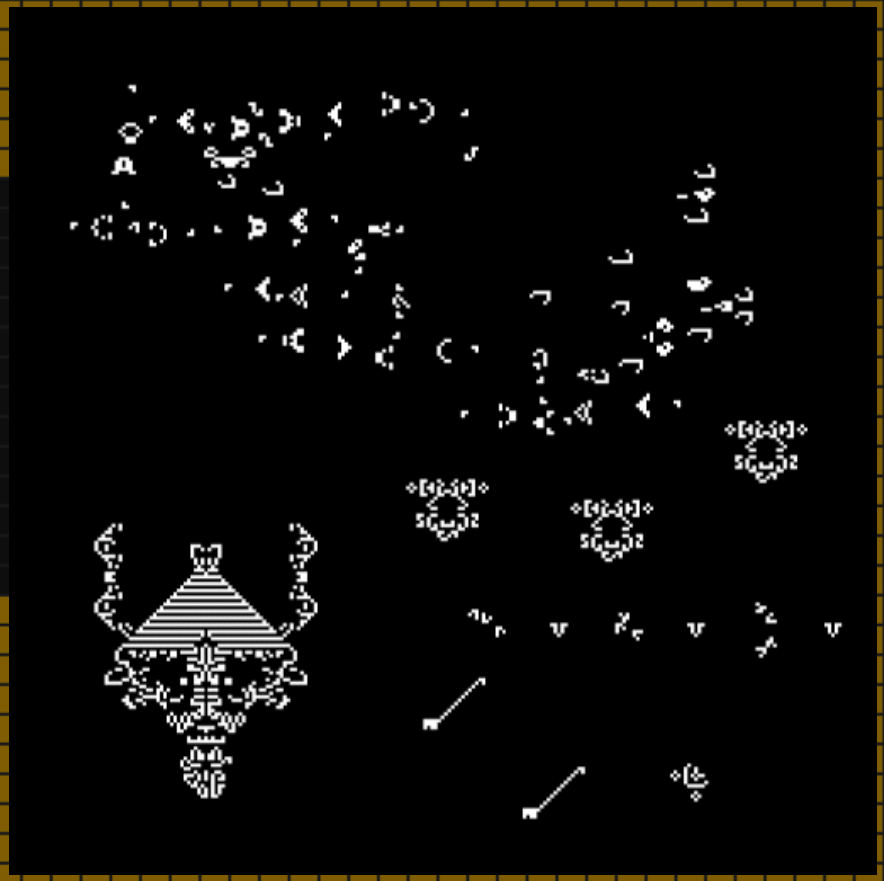
bAG O' Life

bAsic Game Of Life
(with a bonus HDMI output)

Jan Zielasko, Graeme Bragg, Alice Ziuziakowska,
Hossam Omar, Pascal Gesell

Project Idea





Conway's Game of Life in an ASIC with a HDMI output would be cool

Videos reproduced from https://experiments.withgoogle.com/conway-game-of-life

Project Contributions

- Implemented a HDMI output in ASIC.

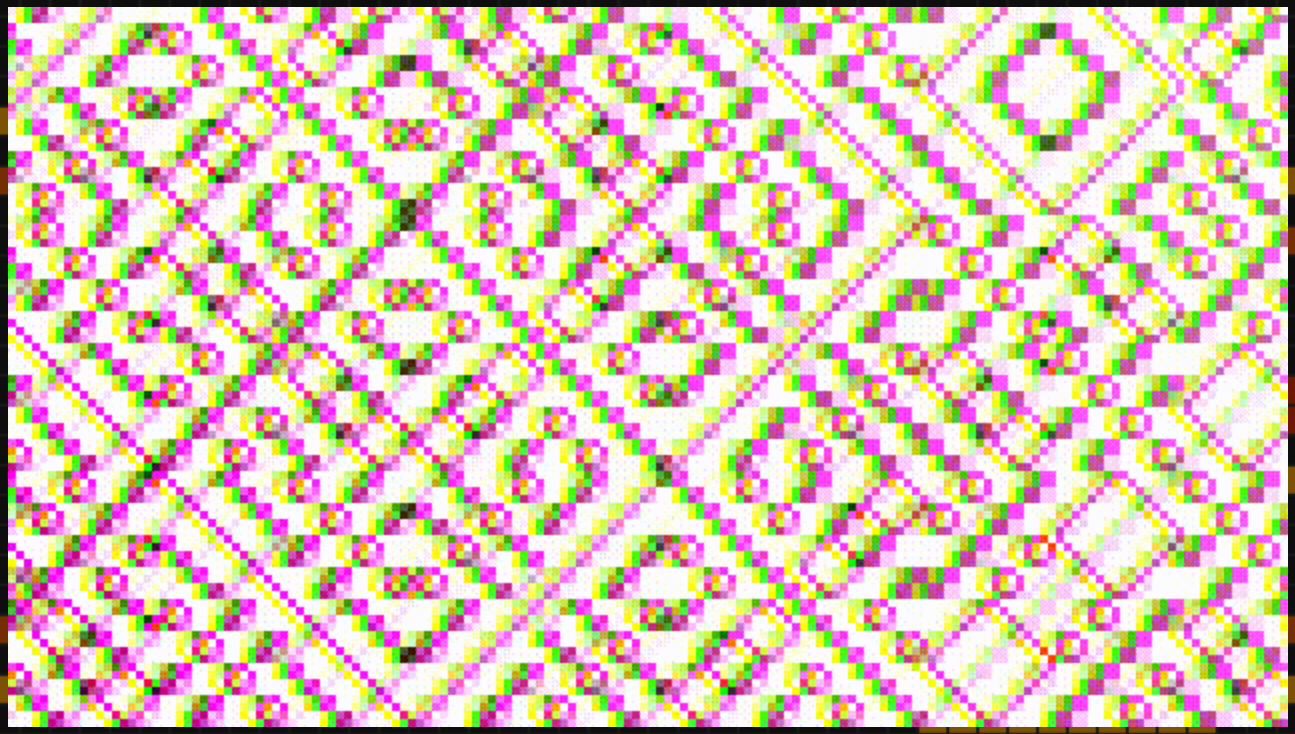
- Added Tang Nano 9K FPGA support to the template (yes, there is a pull-request).
- Showed that mixed language (SystemVerilog + VHDL) works in the flow.
- Implemented demonstration shaders.
- ~~Implemented memory interface & upscaling~~.

Challenges

- HDMI is hard…

  - 125 MHz clock
  - Double-data rate outputs
  - By-5 clock division…
- So we have some hacks

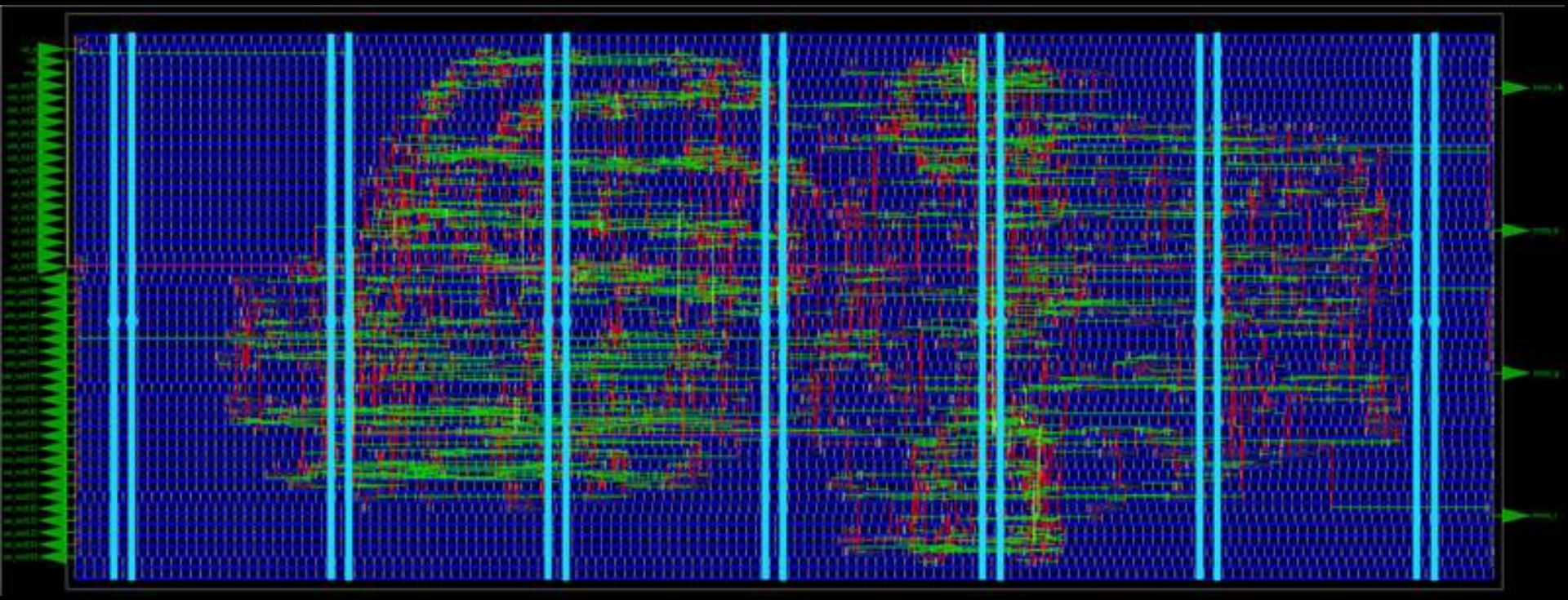
Converting Shaders is Also Hard



- What we see during design is different once we convert high-level floating point operations to integer ops for hardware.
- So much trial and error

Verification

- High-level design
- FPGA Implementation
- OpenRoad
- Testbenches



Any Questions?