Higher-Order reactive Programs

Haai -> Bytecode -> Haai Vm in Elixir

Haai, a pure reactive programming language

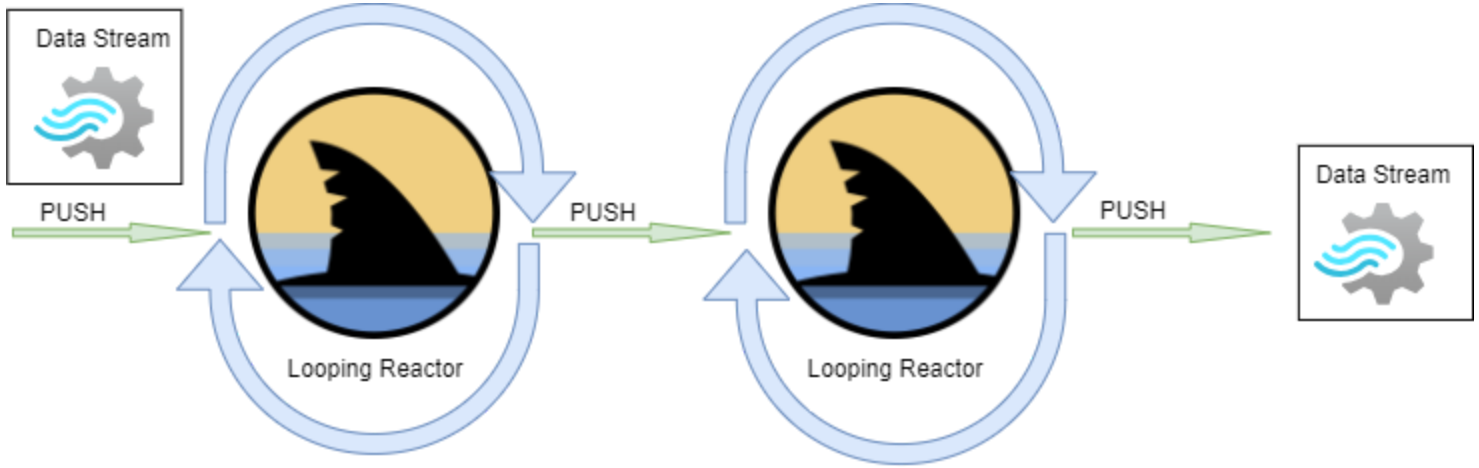
- This is not an Embedded Domain Specific Language, eg: no lifting.

Haai, a pure reactive programming language

- Push-based, Haai updates signals in a glitch-free manner.

Haai, a pure reactive programming language

- A reactor loops, pushing the sources altered by the reactor to the sinks.

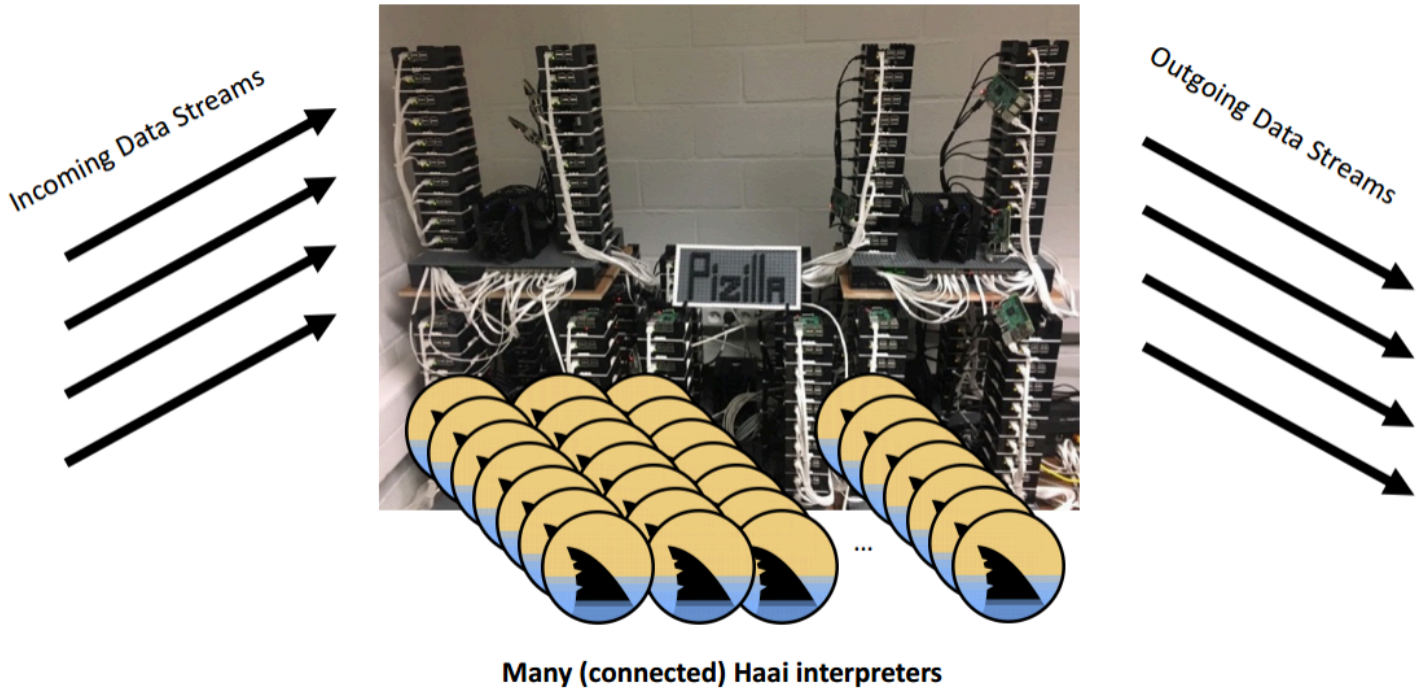


Cluster environments

- make reactive programming with Haai available to cluster environments

Cluster environments

- Many Haai interpreters



Use case, musical reactors

- Microtonal melody generator (eg: 31-EDO, 24-EDO, pure intonation)

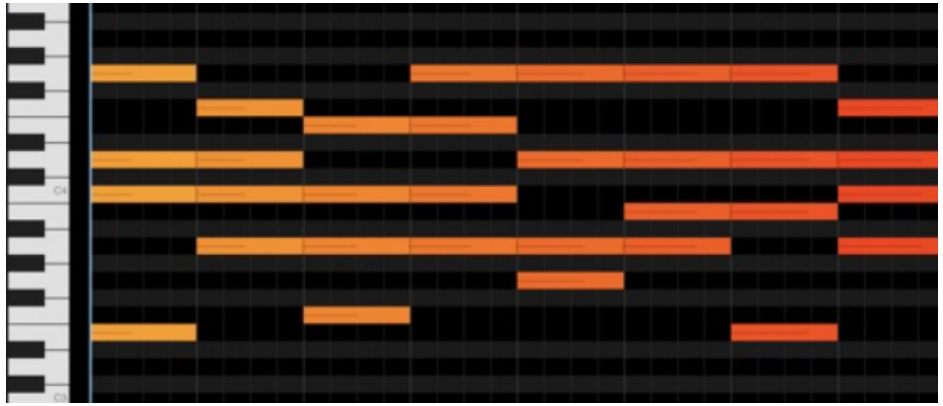
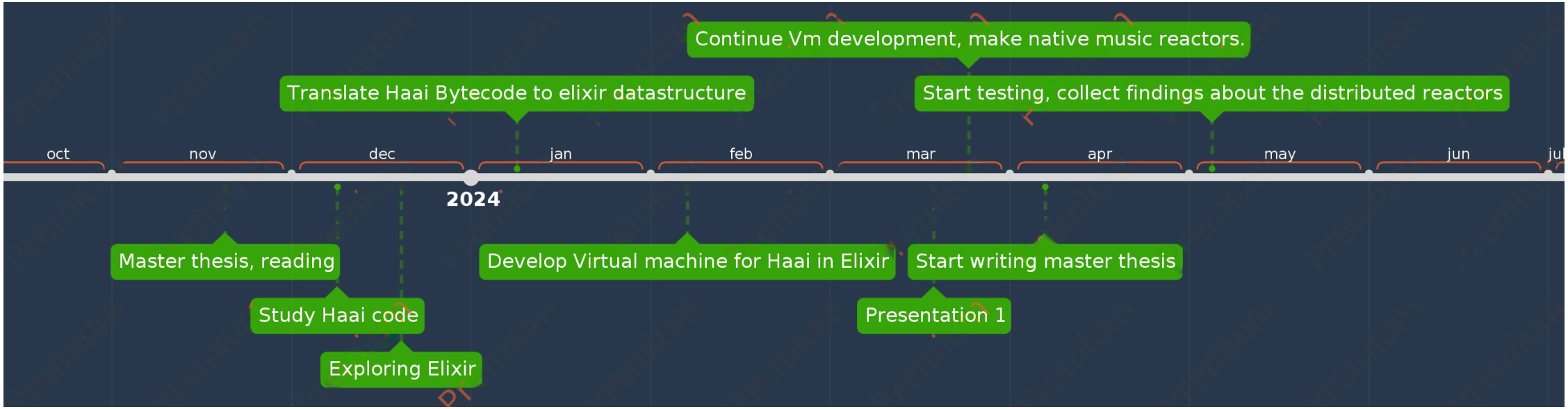


Figure: Standard 12 tone equal temperament, 12 tet

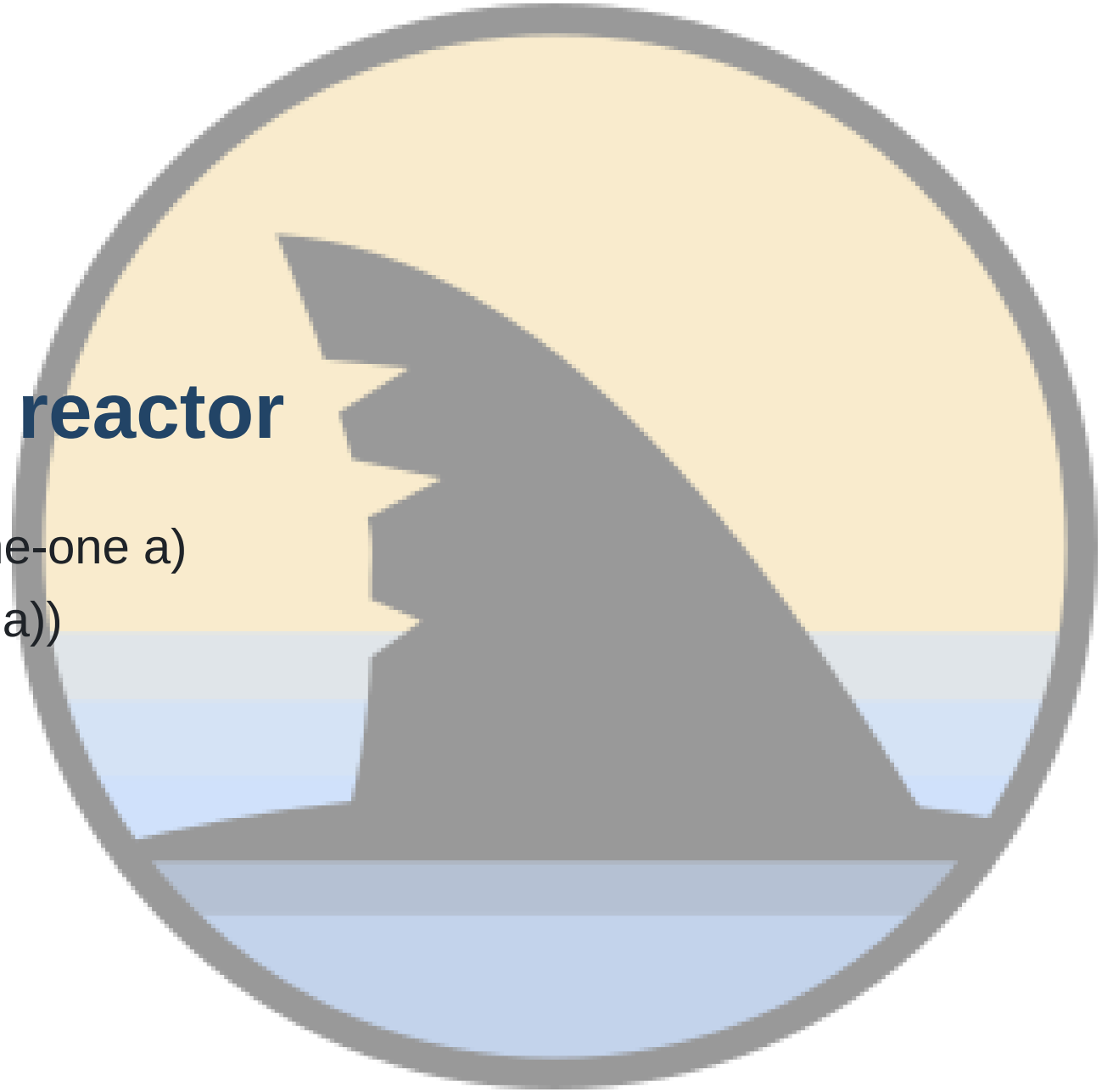
Master thesis, Timeline



Haai virtual machine

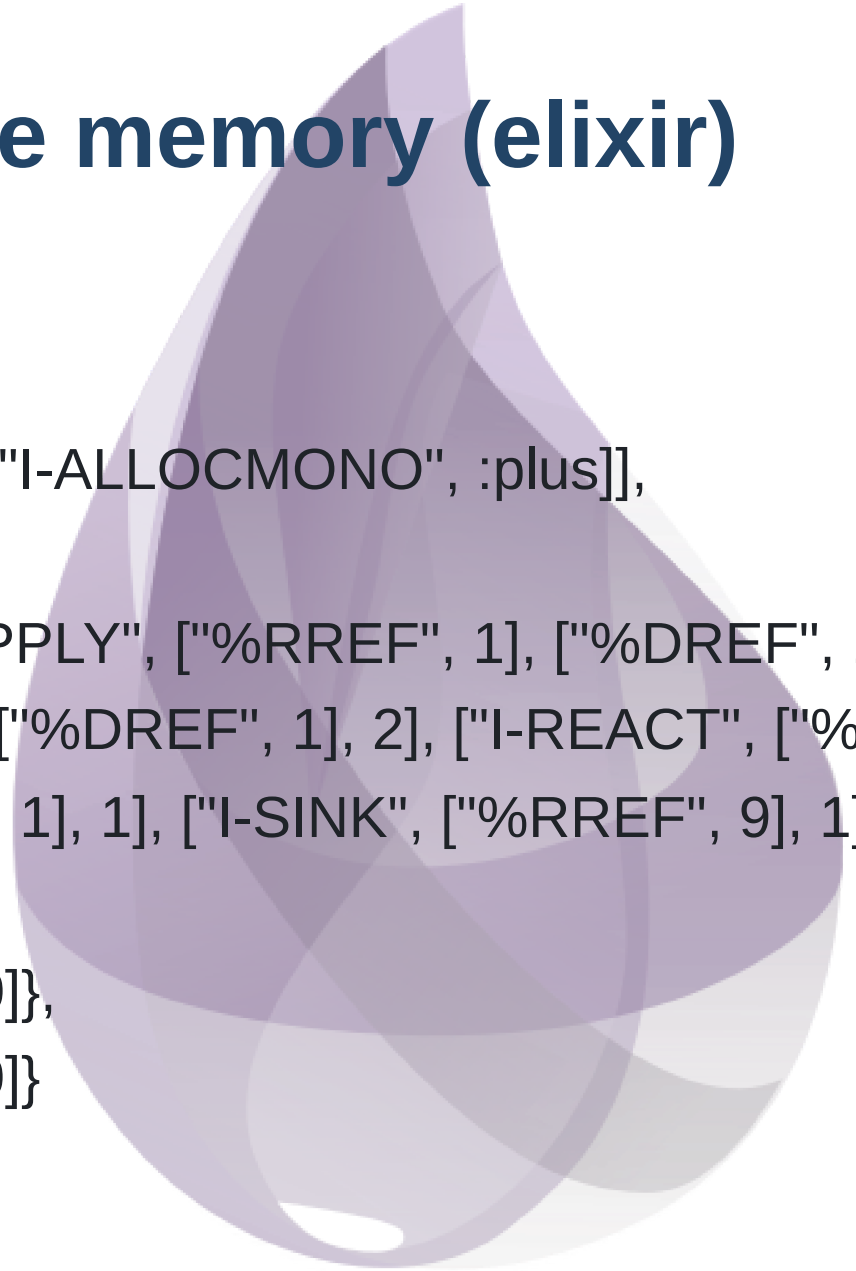
- Haai compiles to bytecode (S-expression) to [elixir [nested lists]].

Haai code, reactor



- (defr (plus-time-one a)
  (def x (+ time a))
  (out (+ x 1)))

Deployment time memory (elixir)



DTM: [{:plus_time_one, [],
[["I-ALLOCMONO", :plus], ["I-ALLOCMONO", :plus]],
[
["I-LOOKUP", :time],["I-SUPPLY", ["%RREF", 1], ["%DREF", 1], 1],
["I-SUPPLY", ["%SRC", 1], ["%DREF", 1], 2], ["I-REACT", ["%DREF", 1]],
["I-CONSUME", ["%DREF", 1], 1], ["I-SINK", ["%RREF", 9], 1]
], []},
{:plus, [0, 33, 9], [], [], [42, 0]},
{:plus, [0, 42, 1], [], [], [43, 0]}
]

Interpreting Haai

- Haai compiles to bytecode (S-expression) to [elixir [nested lists]].
- GenServer to maintain state. (eg: dtm, rtm, src)
- Sources in, Sinks out.

Virtual machine

```
defp run_reaktor(dtm, rtm, rti) do
  # reset the genserver (state) when starting
  case GenServer.whereis(:memory) do
    nil ->
      IO.puts("GenServer :memory is not running.")
    pid ->
      GenServer.stop(:memory)
      IO.puts("GenServer :memory (PID: #{inspect(pid)}) stopped successfully.")
  end
  Memory.start_link(dtm, rtm, [0, 9])
  # execute each rti
  Enum.each(Enum.with_index(rti), fn {instruction, rti_index} ->
    hrr(instruction, rti_index)
    Memory.show_state()
   end)
end
```

Higher-Order reactive Programs

- Haai -> Bytecode -> Haai Vm in Elixir.
- Robust BEAM VM running the HAAI VM distributed.
- Capturing coordination problems.
- Usecase, musical reactors