Ingen: A Meta-Modular Plugin Environment

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"Ingen"

- Nobody? Nothing?
- That company from Jurassic Park?
- ...
- Instrument Generator, "engine"

What is Ingen?

- Ingen is a modular synth, effects processor, mixer, router, MIDI processor, cheese grater, chain degreaser...
- ...a "modular"
- Designed around LV2 plugins
- Usable in many different contexts

Features

- Polyphonic
- Recursive (graphs within graphs)
- Many data types (including events like MIDI)
- Strict client/server architecture
  - Real-time editable
  - Flexible deployment

Philosophy

- Do one thing and do it well
- Integrate with the surrounding environment
- Make use of existing facilities

Existing Facilities?

- Plugins!
- Internals Considered Harmful

Surrounding Environment

In the Lignux audio world, there are several choices:

- JACK application
- LV2 plugin
- Network service
- Physical device (e.g. MOD)

Philausophy

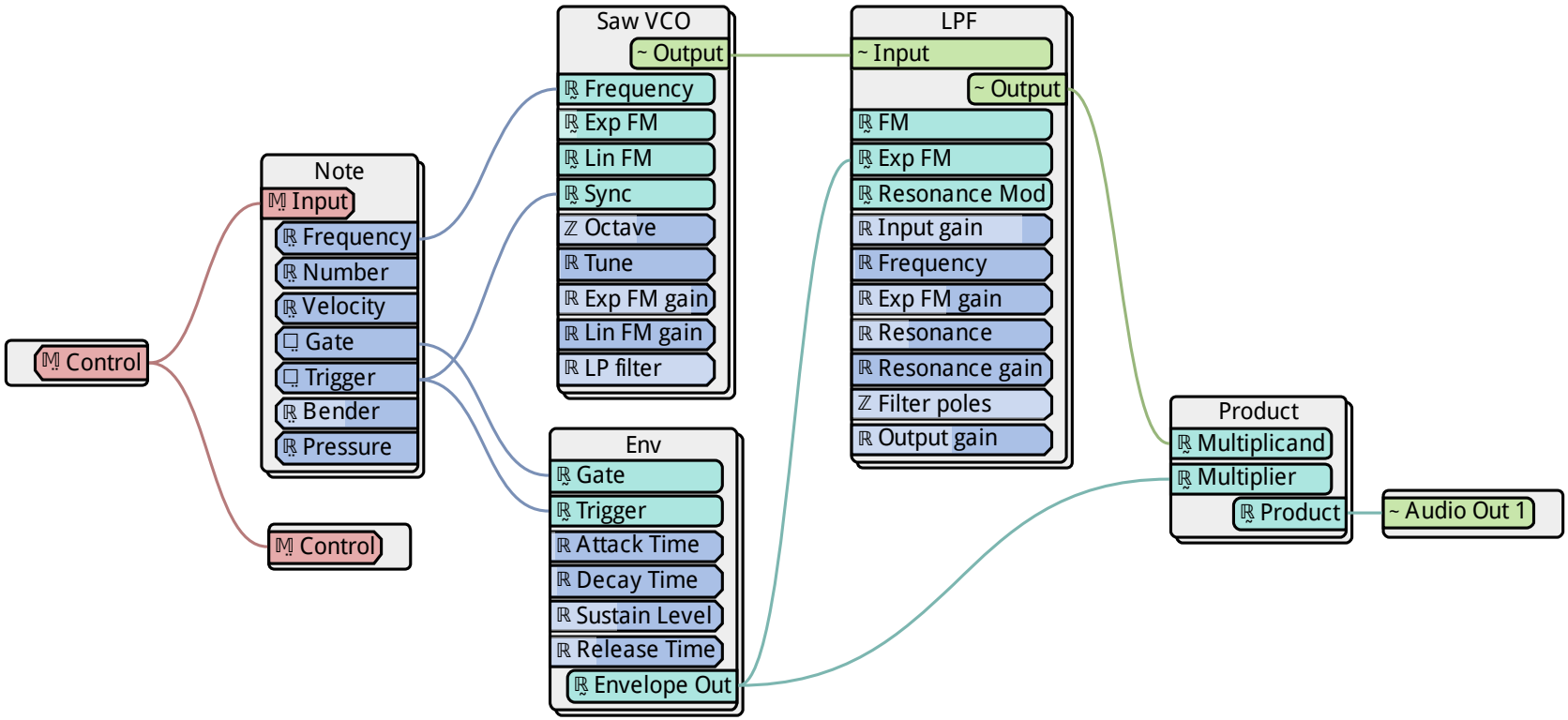
- Do one thing and do it well and do it with real-time safety
- Keep GUIs at arm's length

Terminology

Ingen contains:

- Graphs
- Blocks
- Ports
- Arcs

A Graph


Saw VCO
~ Output
ℝ Frequency
ℝ Exp FM
ℝ Lin FM
ℝ Sync
ℤ Octave
ℝ Tune
ℝ Exp FM gain
ℝ Lin FM gain
ℝ LP filter
LPF
~ Input
~ Output
ℝ FM
ℝ Exp FM
ℝ Resonance Mod
ℝ Input gain
ℝ Frequency
ℝ Exp FM gain
ℝ Resonance
ℝ Resonance gain
ℤ Filter poles
ℝ Output gain
Note
𝕄 Input
ℝ Frequency
ℝ Number
ℝ Velocity
□ Gate
□ Trigger
ℝ Bender
ℝ Pressure
𝕄 Control
𝕄 Control
Env
ℝ Gate
ℝ Trigger
ℝ Attack Time
ℝ Decay Time
ℝ Sustain Level
ℝ Release Time
ℝ Envelope Out
Product
ℝ Multiplicand
ℝ Multiplier
ℝ Product
~ Audio Out 1

Data Model

Everything is described in a simple data model:

- All objects have a path, e.g. `/amp/gain`
- Objects are a dictionary of properties (key:value)
- Inherently extensible: keys can be added without breakage

Data Model Example

A snippet of an Ingen graph:

```
</osc>
  a                ingen:Block ;
  lv2:prototype    <urn:someplugin> ;
  ingen:canvasX    42.0 ;
  ingen:canvasY    24.0 .
```

Protocol

Ingen is controlled by manipulating the model:

- Changes are based on property manipulation
- Everything done with a few generic methods: get, set, put, ...
  - Vaguely HTTP-like
- No special "commands" for specific objects
  - No: `block.move_to`(42, 0)
  - Instead: `set` block.x = 42, block.y = 0

Simple Message Example

Moving a block on the canvas:

```
[
  a                patch:Set ;
  patch:subject    </osc> ;
  patch:property   ingen:canvasX ;
  patch:value      42.0 ;
]
```

Slightly Less Simple Message Example

To add, or put, a new block:

```
[
  a               patch:Put ;
  patch:subject </osc> ;
  patch:body [
    a               ingen:Block ;
    lv2:prototype <urn:someplugin> ;
    ingen:canvasX 42.0 ;
    ingen:canvasY 24.0 ;
  ]
]
```

Who Cares?

- Elegant correspondence between protocol and data model
- Identical syntax used on the wire and in saved files
- Conceptually simple

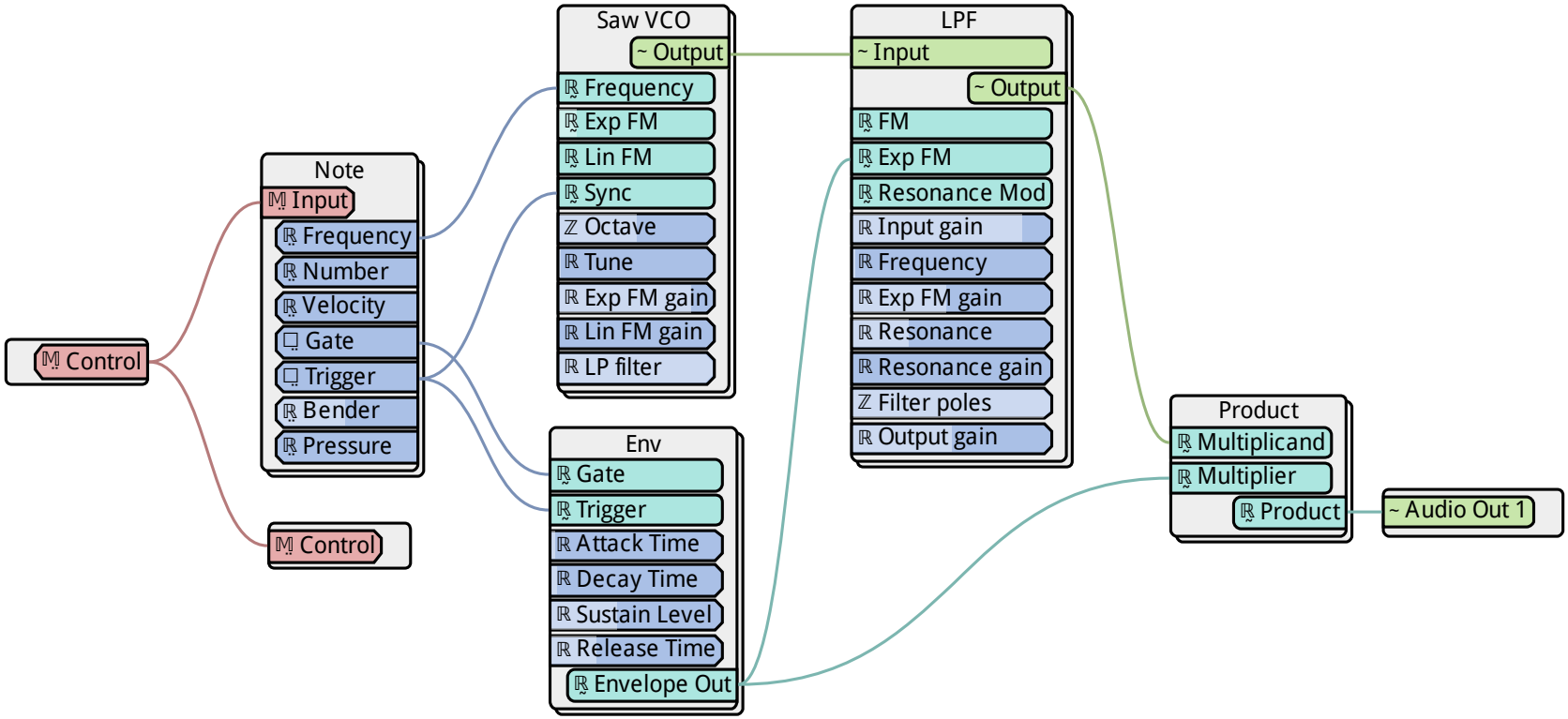
No, really... who other than you cares?

- Allows flexible deployment:
- Ingen as server, network controlled from a different machine
  - Dump text protocol for a plain text log of activity
- Run Ingen as an LV2 plugin, control via LV2 ports
  - Protocol in binary (LV2 atoms, native `float`, etc)
  - No shady underhanded communication
  - GUI talks to engine via ports like any LV2 plugin
- Extensible, properties can be added freely
- A few methods are capable of everything

Scenarios

- Need to put some non-linear in another host (e.g. Ardour mixer strip)
- Remote-controllable "glue" for a headless JACK box
- Want to publish a plugin but can't or don't want to code
  - Ingen graphs are LV2 plugins
  - . . . literally. No special export, no compilation; the one and only save format is LV2 compatible
  - Save to `LV2_PATH` (typically `~/.lv2`) and graphs will be visible in any LV2 host

A Synth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Velocity
Gate
Trigger
Bender
Pressure
Control
Control
Env
Gate
Trigger
Attack Time
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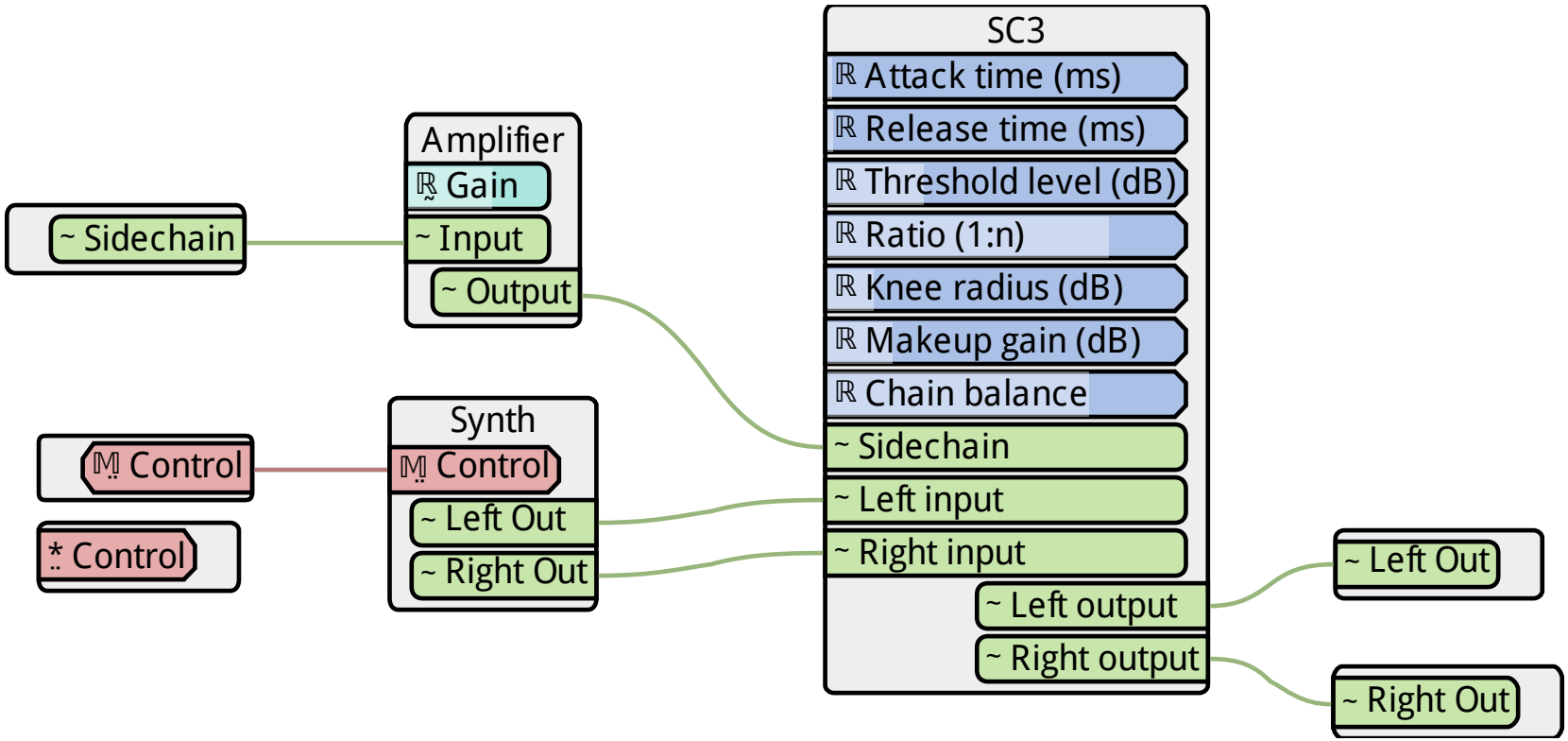
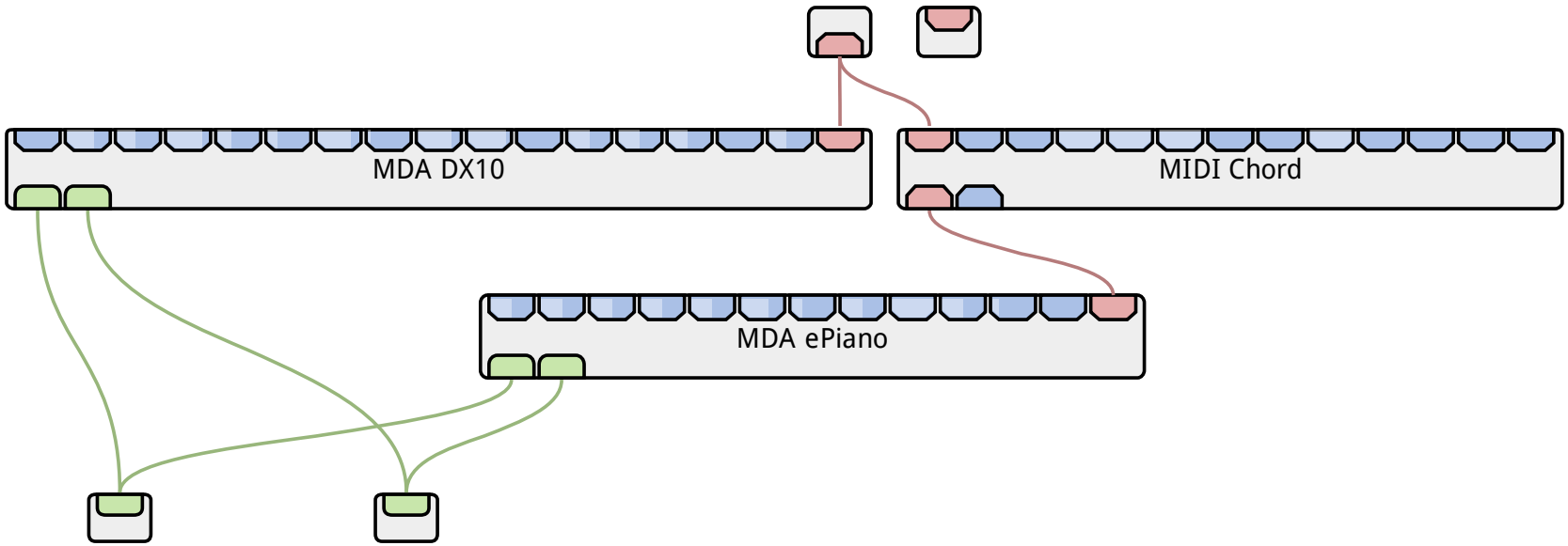
Sustain Level
Release Time
Envelope Out
Product
Multiplicand
Multiplier
Product
~ Audio Out 1

Flexible I/O (Sidechains)



MIDI Filtering



Mundane Improvements

- Performance / memory consumption improvements
- Better state/preset support
- Stability, more rigorous testing
- GUI polish

Whiz-Bang

- Control panel building (presentation mode)
- Novel presentation of patching canvas? (Pies?)
- Integrated online patch repository (MOD?)
- Dynamic ports when running as LV2 plugin
- Design plugin suite for message-based programming
- Make it as simple as possible for users to publish "plugins"