IPyCLAM
Enpowering CLAM with Python

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http://clam-project.org

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Outline

- Introduction to CLAM
- API
- Engines (CLAM, JACK...)
- Prototyping
- Conclusions

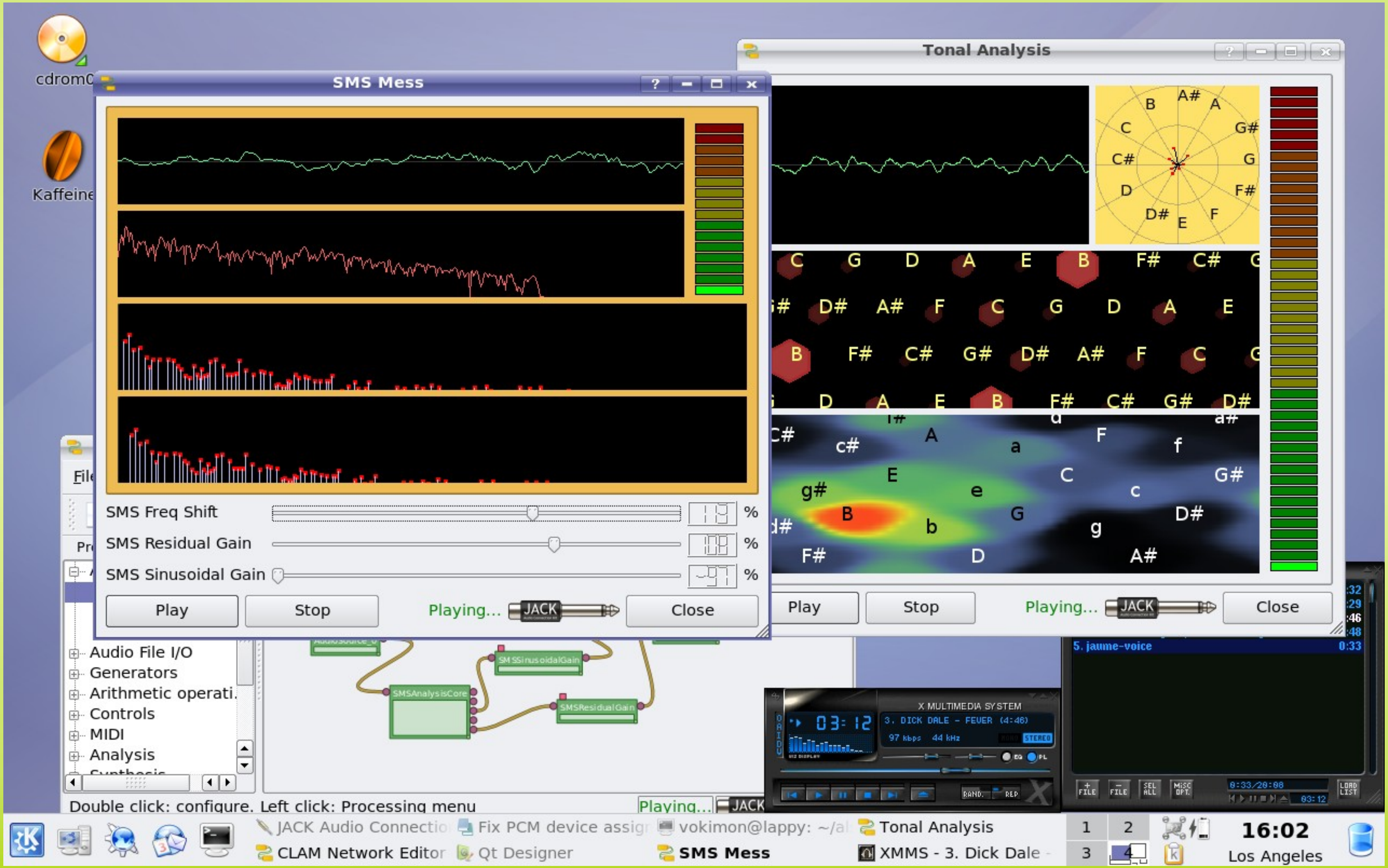
The CLAM project

- Born at Universitat Pompeu Fabra, 2001
- Adopted by Barcelona Media Foundation, 2007
- Startups, adquisitions by big corporations...
  - Team members busy
  - Potential contributions won't be released
- Nowadays, it has no support from any parent institution like it had in the past.

Buried? Not entirely!!

- A bunch of developers still push in their spare time.
- Big project, few hands...
- Wanna join?

CLAM



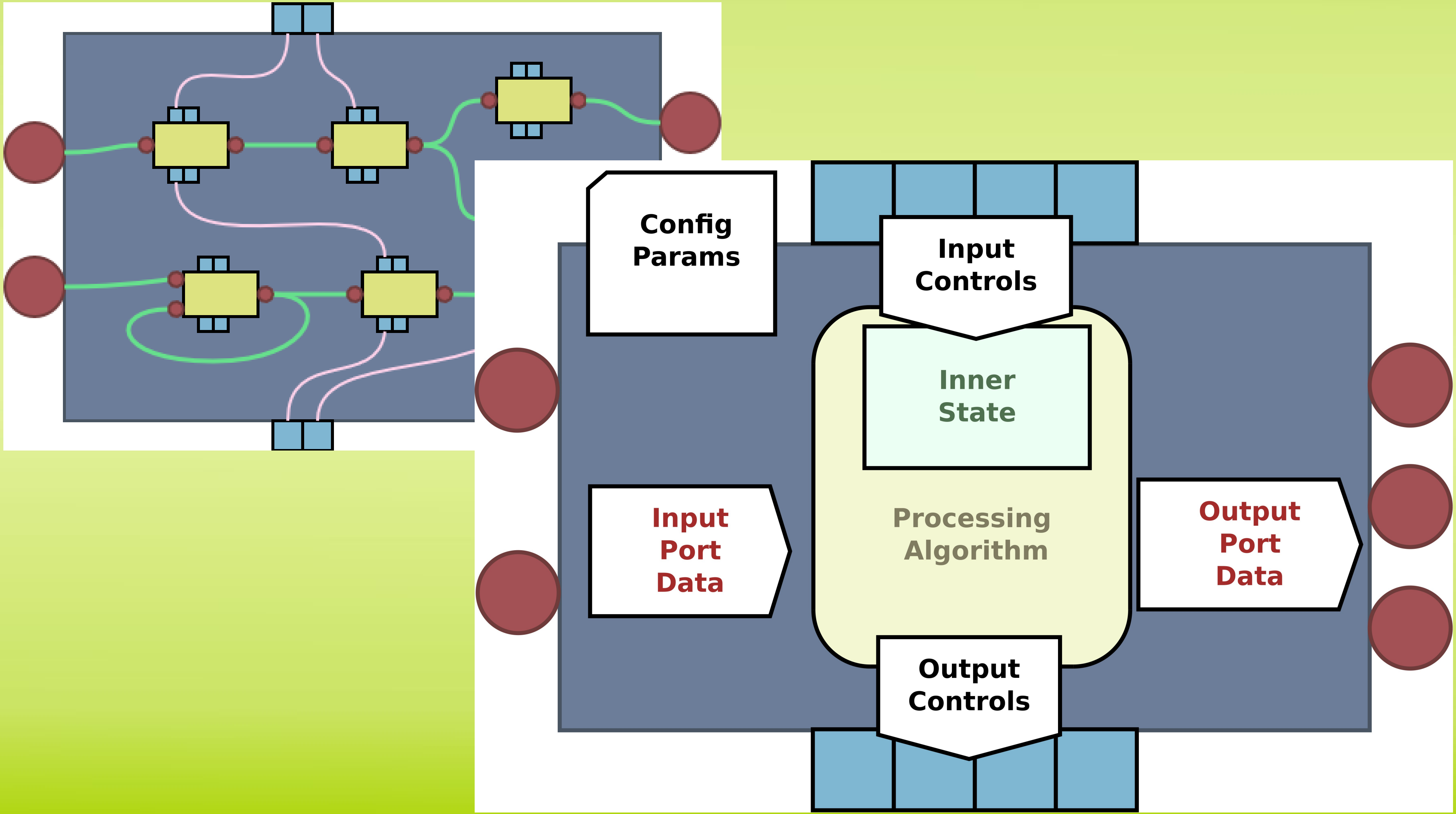
SMS Freq Shift %

SMS Residual Gain %

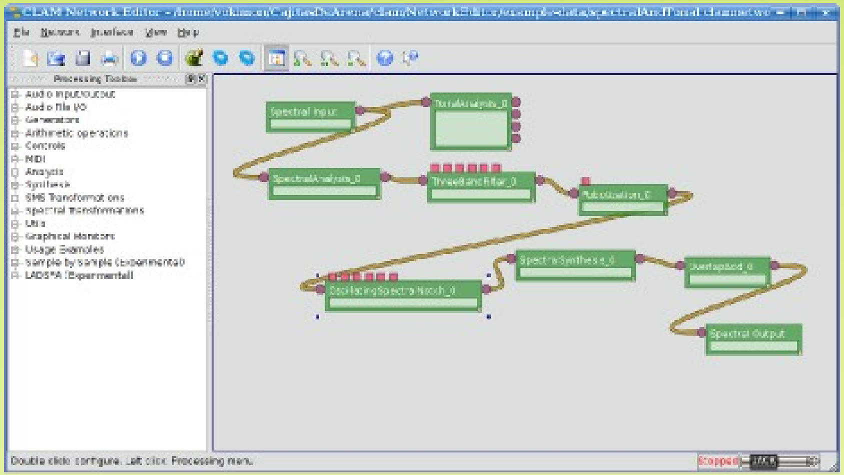
SMS Sinusoidal Gain %

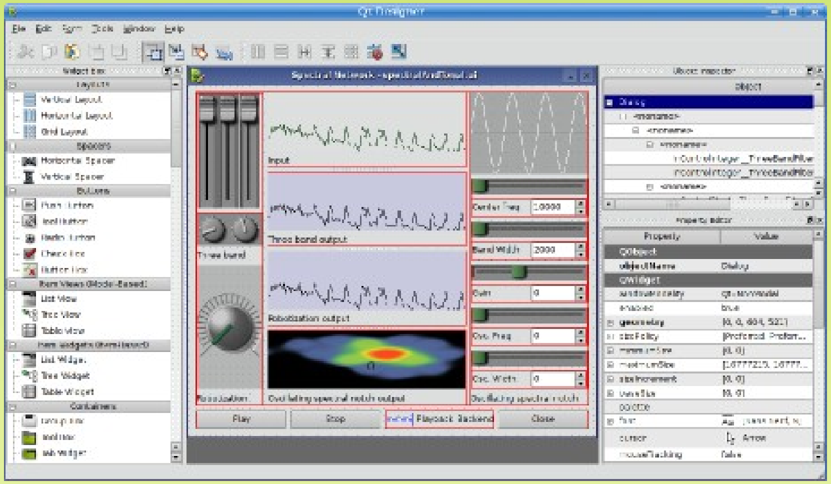
Double click: configure. Left click: Processing menu

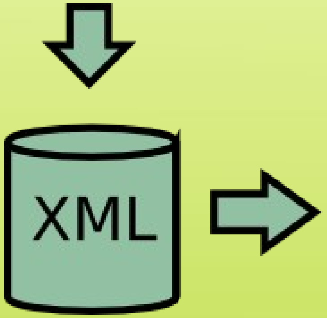
CLAM: building blocks

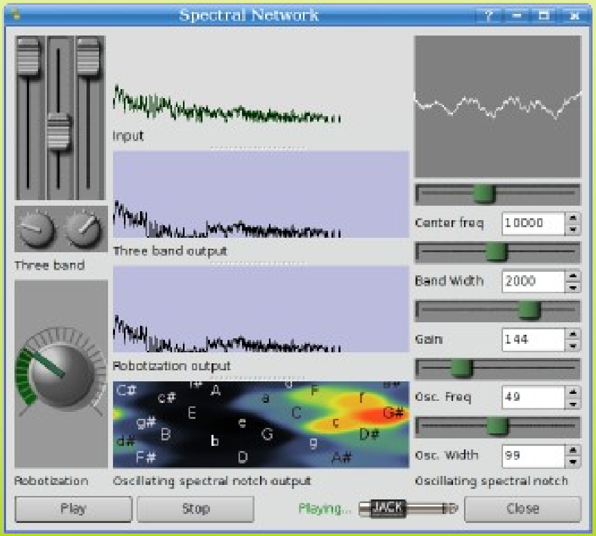


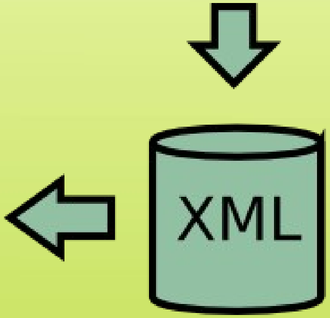
CLAM: visual prototyping



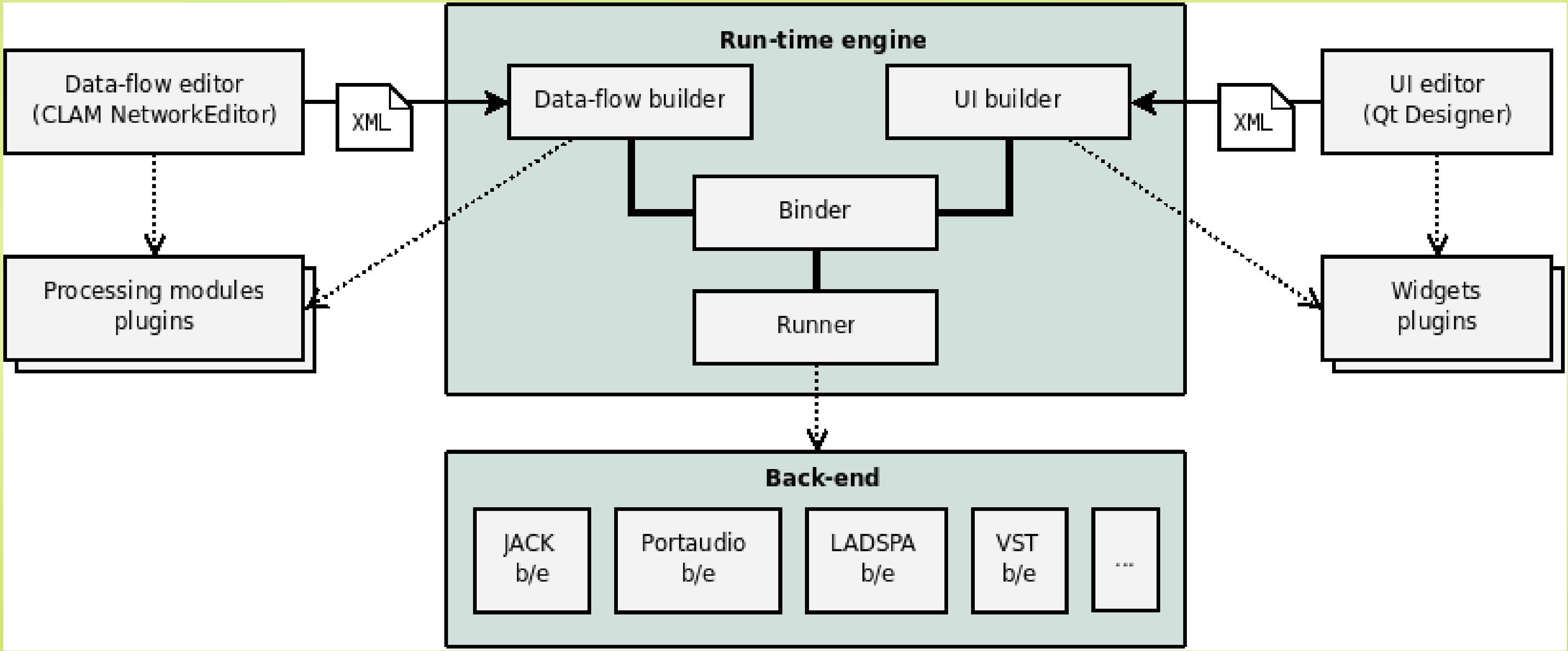








CLAM: visual prototyping



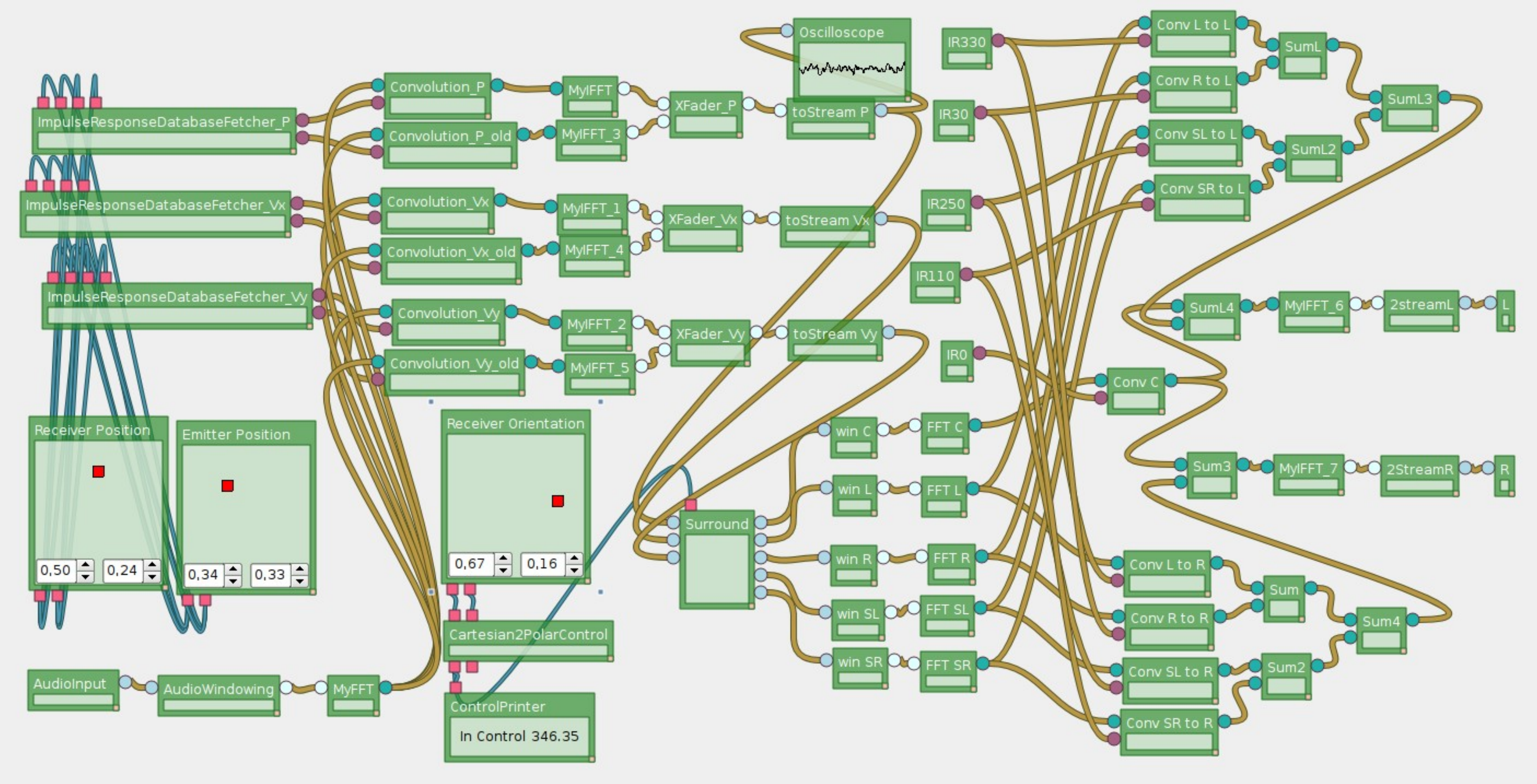
Why Python?

- Fast development
- Interactive
- But... wasn't Python unsafe for real-time?
    - Nevermind, RT code is isolated inside modules
    - Let Python play the glue role

How does IPyClam empower CLAM?

- Powerful prototyping language
  - PySide/PyQt4
- Interactive manipulation of networks
- Serialization format
- Parametric networks

A not so complex network



API design goals

- Do not mimic C++ API
- Python expressiveness
  - Slices, dynamic attributes, iterators...
- Redundant API:
  - Offer the convenient API but also the API that being less convenient cover all cases.
- Interactive use:
  - Object discovery by tab completion

Convenience vs. versatility

- Convenient way

  ```
  net.processing1.port1
  ```

  - Short and enables tab completion discovery
- Most versatile way

  ```
  net[“processing1”].inports[“port1”]
  ```

  - Invalid Python identifiers
  - Collisions with existing methods/attributes
  - Collisions with outports/controls/configs

An example: JACK stereo wire

```
from ipyclam import Network
n = Network()
n.source = “AudioSource”
n.sink = n.types.AudioSink
n.source.NSources = 2
n.sink.NSinks = 2
n.source > n.sink
n.backend = “JACK”
n.play()
```

Module creation

- Assign a new attribute or item

```
n.newproc = ...
n[“newproc”] = ...
```

- To a string

```
n.newproc = “AudioSource”
```

- Or to a member of n.types.

```
n.newproc = n.types.AudioSources
```

- Provides available types by tab completion

Module configuration

- Attribute or item assignment

```
net.myprocessing.parameter = “value”
net.myprocessing['parameter'] = “value”
net.myprocessing.config.parameter = “value”
```

- Holding reconfiguration

```
with net.myprocessing.config as c :
    c.parameter1 = 1000
    c.parameter2 = 2000
```

Connections: Broadcasting

- One to one

```
net.source.outport1 > net.sink.inport1
```

- One to many

```
net.source.outport1 > net.sink
```

- Many to many

```
net.source > net.sink
```

Connections: Slices

- Connecting intervals

```
net.source[2:7] > net.sink
```

- Connecting just even ports

```
net.source[::2] > net.sink
```

- Inverting channel order

```
net.source[::-1] > net.sink
```

Iterables

- Iterable objects:

```
porttypes = {
    port.name: port.type
    for port in net.myproc.outports }
```

  - net.proc.outports
  - net.proc.inports
  - net.proc.outcontrols
  - net.proc.incontrols
  - net.processings
  - net.types
  - net.proc.port.peers
  - net.proc.config

Audio backends and transport

- Setting the backend property

  net.backend = “PortAudio”

- Controling the playback

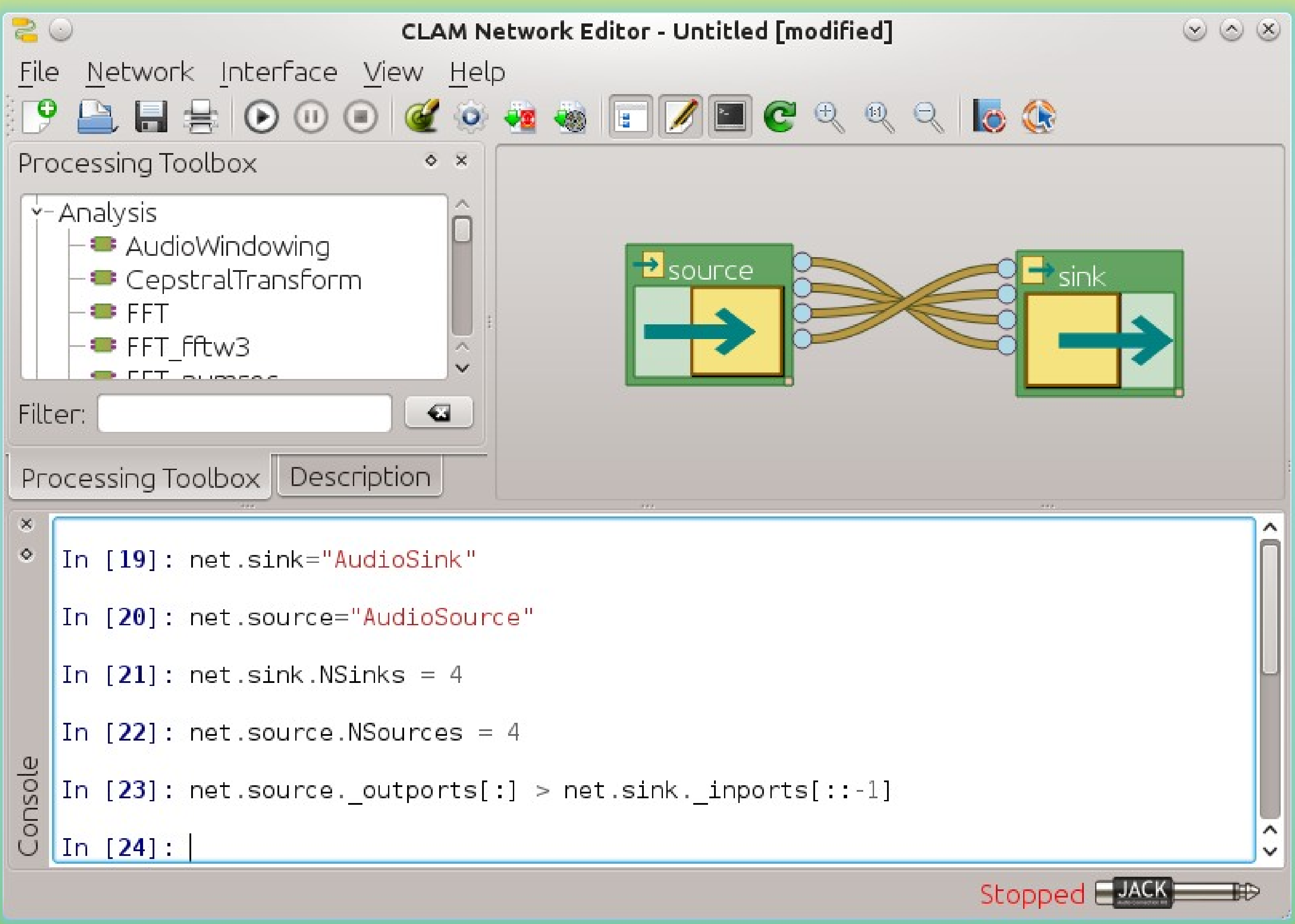
  net.play(), net.stop(), net.pause()

  net.isPlaying(), net.isStopped(), net.isPaused()

Self replicable

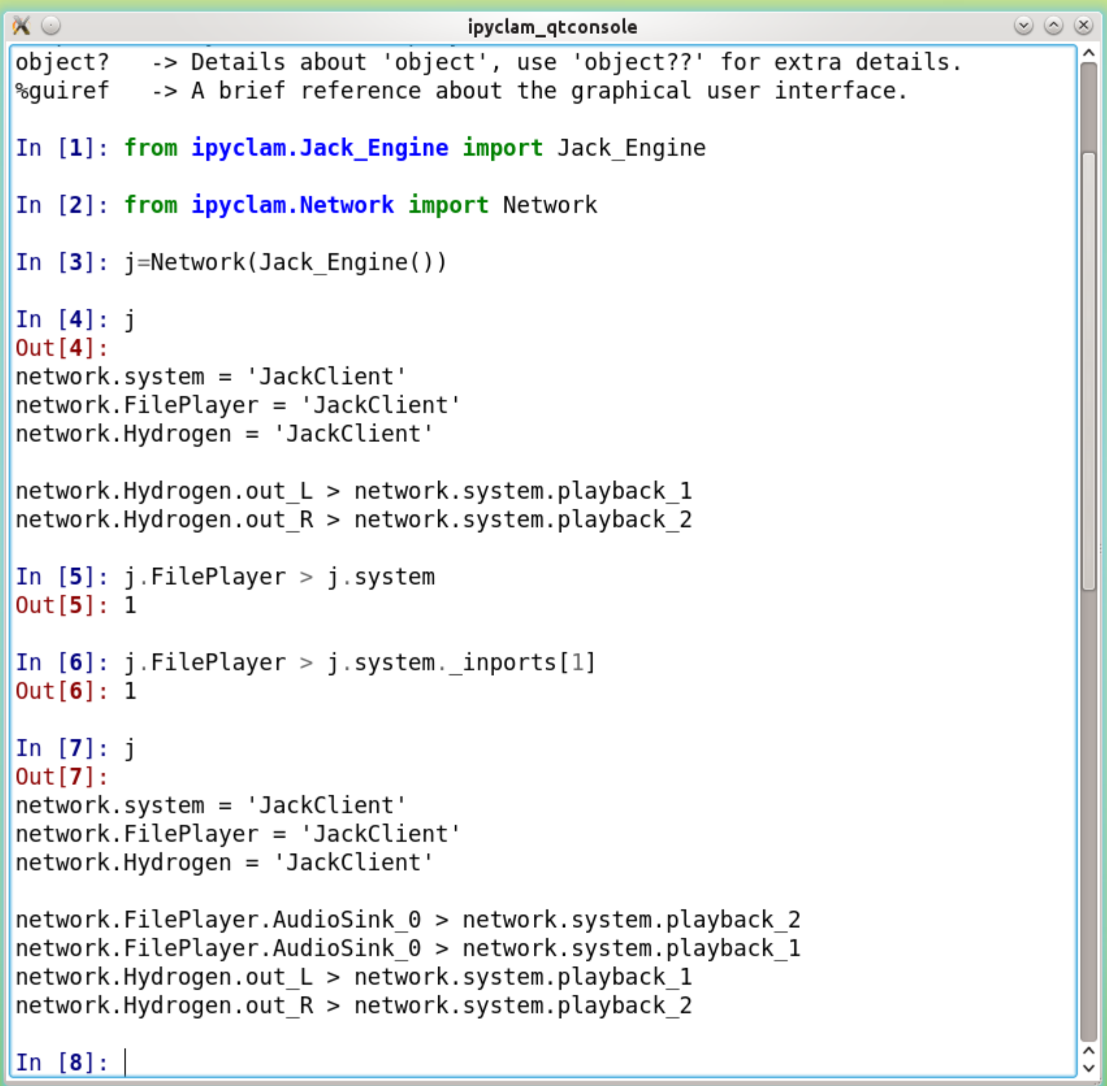
- net.code() generates the code needed to regenerate itself.
- Alternative to current XML serialization
- More readable
- Not safe if using the Python interpret!!
- Fast display: If you just type 'net' prints the code.

Integrated console



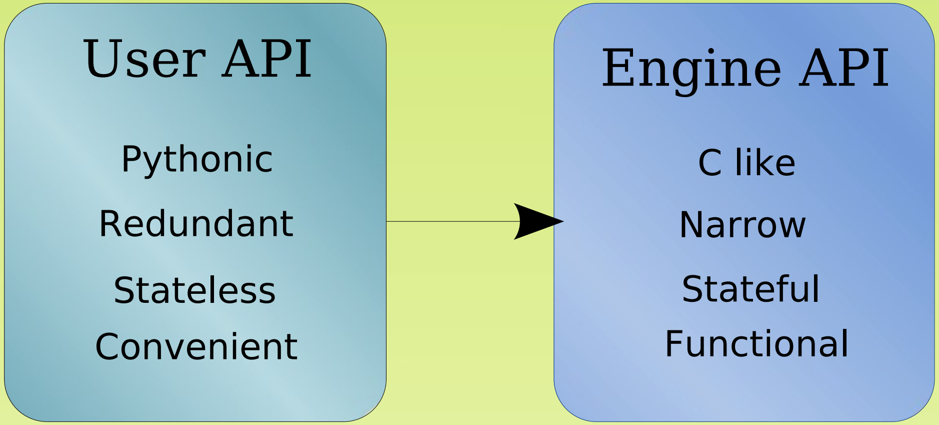
```
In [19]: net.sink="AudioSink"

In [20]: net.source="AudioSource"

In [21]: net.sink.NSinks = 4

In [22]: net.source.NSources = 4

In [23]: net.source._outports[:] > net.sink._inports[::-1]

In [24]: 
```

JACK engine, ¿IPyJack?



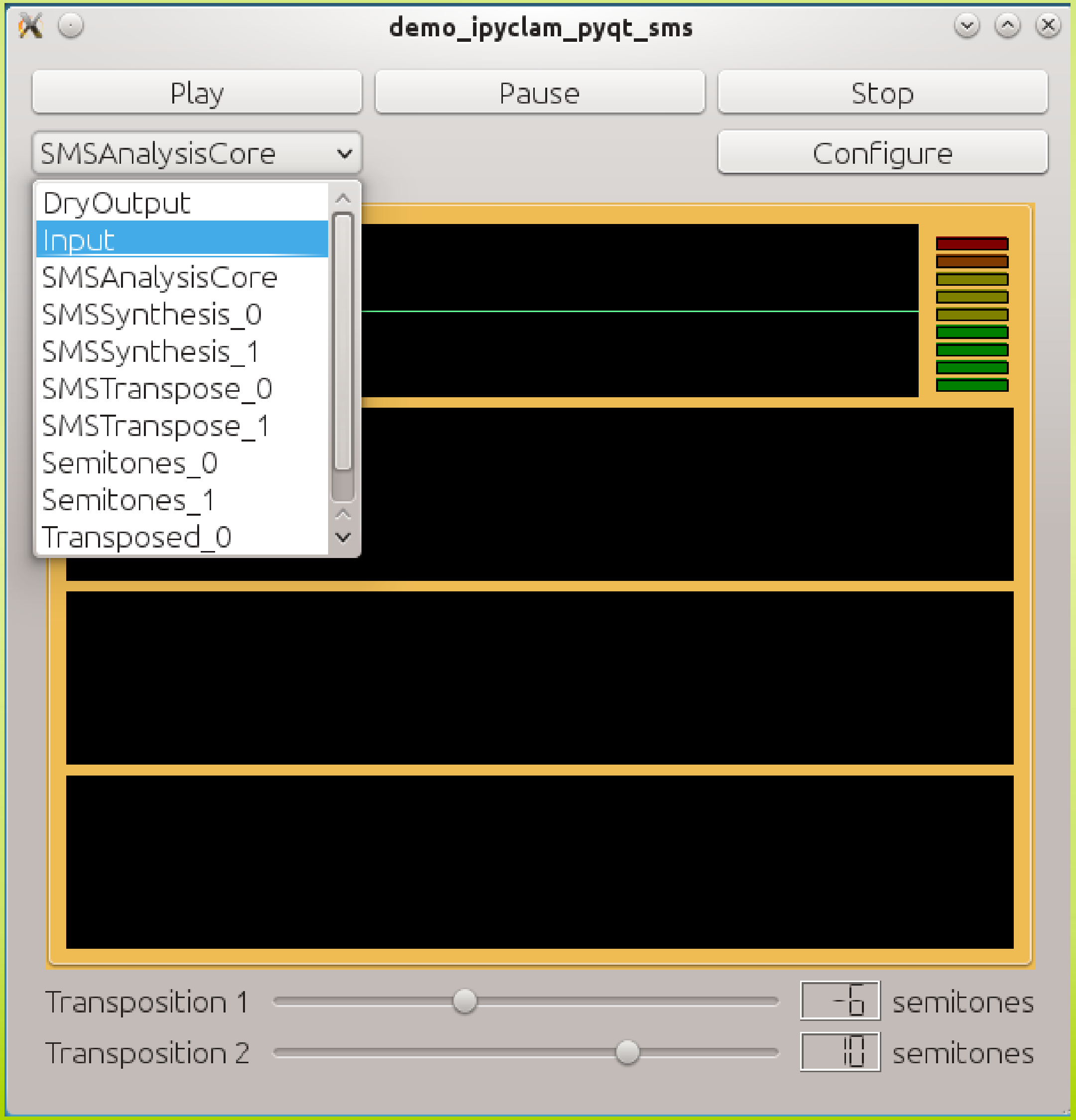
```
object?   -> Details about 'object', use 'object??' for extra details.
%guiref   -> A brief reference about the graphical user interface.

In [1]: from ipyclam.Jack_Engine import Jack_Engine

In [2]: from ipyclam.Network import Network

In [3]: j=Network(Jack_Engine())

In [4]: j
Out[4]:
network.system = 'JackClient'
network.FilePlayer = 'JackClient'
network.Hydrogen = 'JackClient'

network.Hydrogen.out_L > network.system.playback_1
network.Hydrogen.out_R > network.system.playback_2

In [5]: j.FilePlayer > j.system
Out[5]: 1

In [6]: j.FilePlayer > j.system._inports[1]
Out[6]: 1

In [7]: j
Out[7]:
network.system = 'JackClient'
network.FilePlayer = 'JackClient'
network.Hydrogen = 'JackClient'

network.FilePlayer.AudioSink_0 > network.system.playback_2
network.FilePlayer.AudioSink_0 > network.system.playback_1
network.Hydrogen.out_L > network.system.playback_1
network.Hydrogen.out_R > network.system.playback_2

In [8]: |
```

How?



- Original intent: decouple syntactic sugar from the code that does stuff. Mock-ups.
- Side effect: Reimplementing the engine API for a different system, like JACK is fast!

PySide/PyQt4 integration



Replicating Prototyper behaviour

```
import QtGui from PySide
import ipyclam.ui.PySide as ui

app = QtGui.QApplication(sys.argv)
net = ipyclam.Network()
net.load(“sms.clamnetwork”)
w = ui.loadUi(“dialog.ui”)
net.bindUi(w)
w.show()
net.play()
app.exec_()
```

A simple osciloscope

- Creating widgets with Qt factories
- Assigning binding properties:

```
net.source = “AudioSource”
w = ui.createWidget(“Oscilloscope”)
w.setProperty(“clamOutport”, “source.1”)
net.bindUi(w)
w.show()
...
```

Conclusions

- Nice API!
- Reusable for other systems like JACK
- Prototyping: Qt + Python + CLAM
- Integrated console for interactive manipulation and exploration of networks.

Future work

- Fixing NetworkEditor interaction:
  - Canvas update.
  - Processing placement
- Examples, examples, examples.
- Numpy based audio backend
- Modules in Python for offline processing
- Other engines: gAlan, Patchage...

Questions?

Thanks