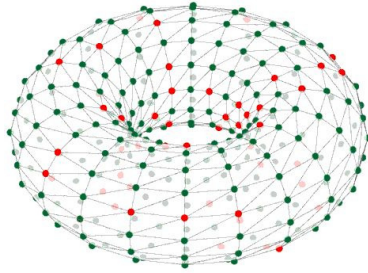


External Devices



Alan Stokes, Andrew Rowley

SpiNNaker Workshop
September 2016



European Research Council
Established by the European Commission



Human Brain Project



1. How to add external devices that communicate through the SpiNNaker Link into your PyNN scripts.
2. How to add external devices that communicate through the FPGA/SATA connector into your PyNN scripts.
3. How FPGA's are used within multi board systems.

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Real time systems?



SpOmnibot
(Retinas & Motors)



FPGA connector



A Retina



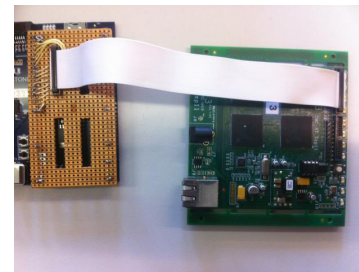
A Osaka retina



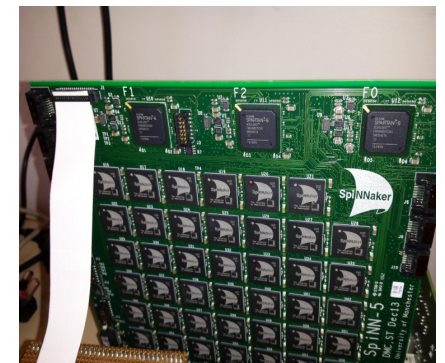
A Cochlea

How to connect devices to a spiNNaker board

Connect the device to the SpiNNaker link connector

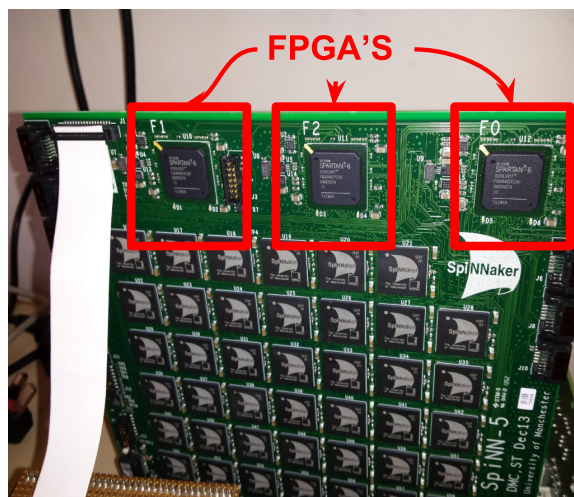


connecting to a
spinn-3 Board



connecting to a
spinn-5 Board

1. The FPGA's need reprogramming to support external device plugin.
2. This reprogramming is not done by the tools to date.



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Using an external device: Calls from PYNN

```
import pynn.spinnaker as p
p.setup( timestep=1.0,
         min_delay = 1.0,
         max_delay = 32.0)

# set up populations
pop = p.Population(
    1, p.ExternalDevice, {
        'spinnaker_link':0,
        'board_address':None OR 192.168.0.253,} label='pop1'))

# set populations to record spikes
pop.record() External devices cant be recorded

# run the simulation for 10000 ms
p.run(10000)
```

Using an external device: Calls from PYNN

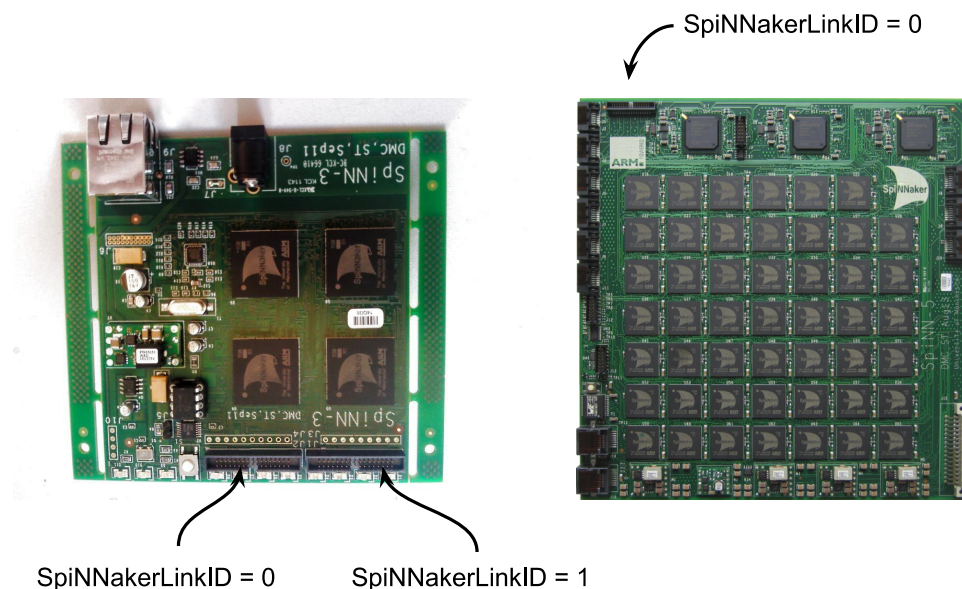
```
import pynn.spinnaker as p
p.setup( timestep=1.0,
         min_delay = 1.0,
         max_delay = 32.0)

# set up populations
pop = p.Population(
    1, p.IfCurExp, {} label='pop1'))

# set populations to record spikes
pop.record()

# run the simulation for 10000 ms
p.run(10000)
```

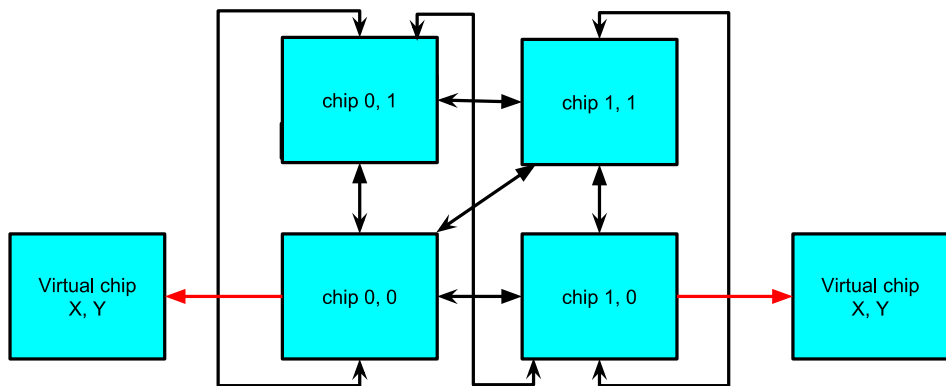
Which SpiNNaker Link is which?



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How this works in detail

1. Every Spinnaker link is defined as a link to a virtual chip
2. Your device vertex is then placed within this virtual chip.

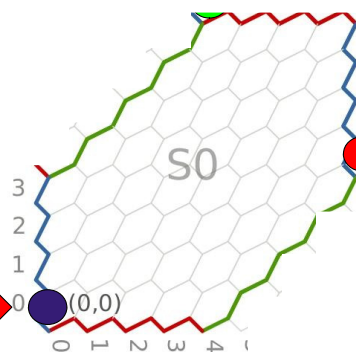


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Board Address?

- 192.168.0.1
- 192.168.0.3
- 192.168.0.5

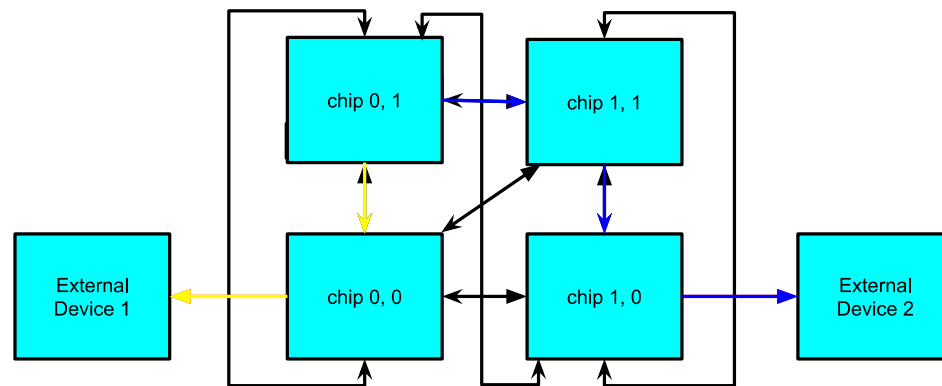
When set to None (default behaviour)



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Why does it matter?

1. Routing won't work if mixed up

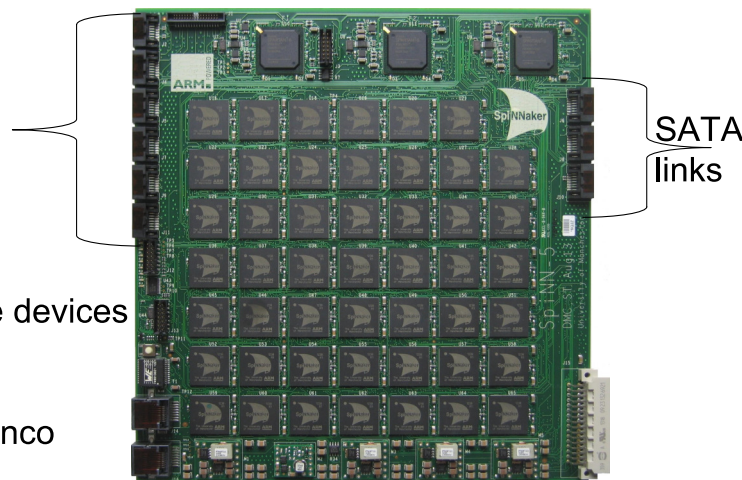


1

2

SATA Link connected devices!

torus
SATA
links



People who have devices

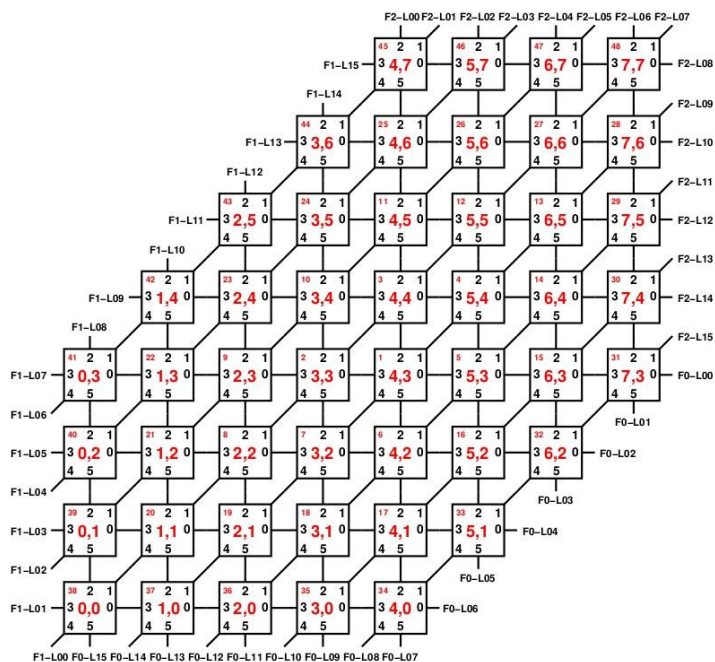
1. Bernabe Linares-Barranco
2. Jorg Conradt

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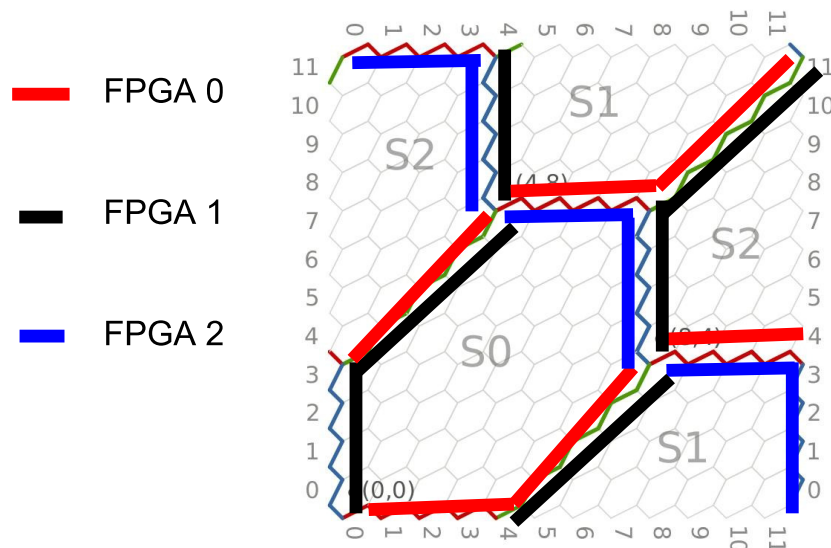
How to represent this in your PyNN scripts.

```
p.Population(2000, external_devices.ArbitraryFPGADevice,
{
'fpga_link_id': 12,
'fpga_id': 1,
'board_address': None OR 192.168.0.1
},
label='External sata thing')
```

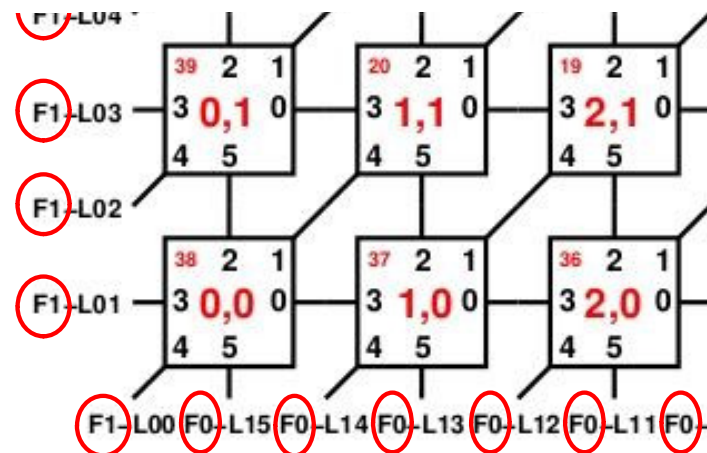
What the input parameters mean?



How do FPGA's work in Multi-board machines?

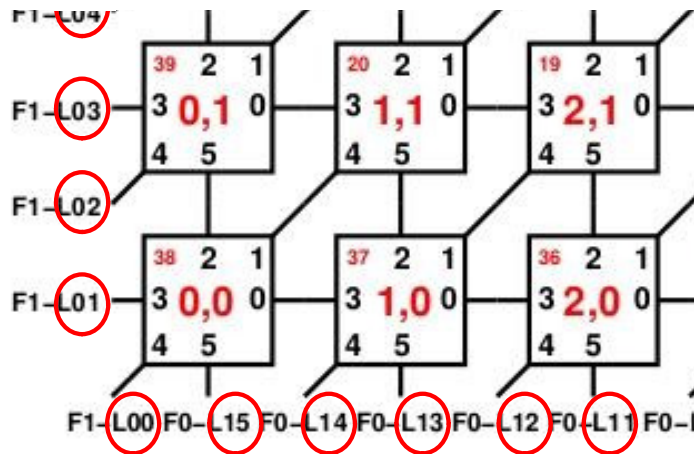


What the input parameters mean?



FPGA_ID = ○

What the input parameters mean?



FPGA__link_ID =

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What you need to do to get SATA links working for your device.

1. Reprogram the FPGA's to support the communication between device and PyNN related models.
2. **The reprogramming needs to result in a disconnected edge between two chips who's communication is done through the FPGA.**
3. Extend or use the ArbitraryFPGADevice vertex to represent any extra constraints you need.

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Board Address again

- 192.168.0.1
- 192.168.0.3
- 192.168.0.5

When set to None
(default behaviour)



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Summary

1. Discussed External devices plugged in through the SpiNNaker Link.
2. Discussed External devices plugged in through the FPGA / SATA connector.
3. Discussed How the FPGA's interact in the communication fabric.

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