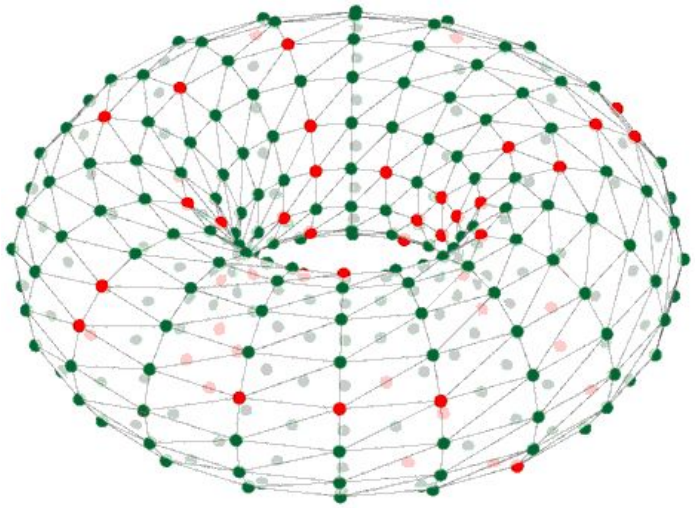
MANCHESTER 1824

SpiNNaker: What's New



Andrew Rowley and Alan Stokes

HBP CodeJam Workshop #7

Jan 2016

European Research Council
Established by the European Commission

Human Brain Project

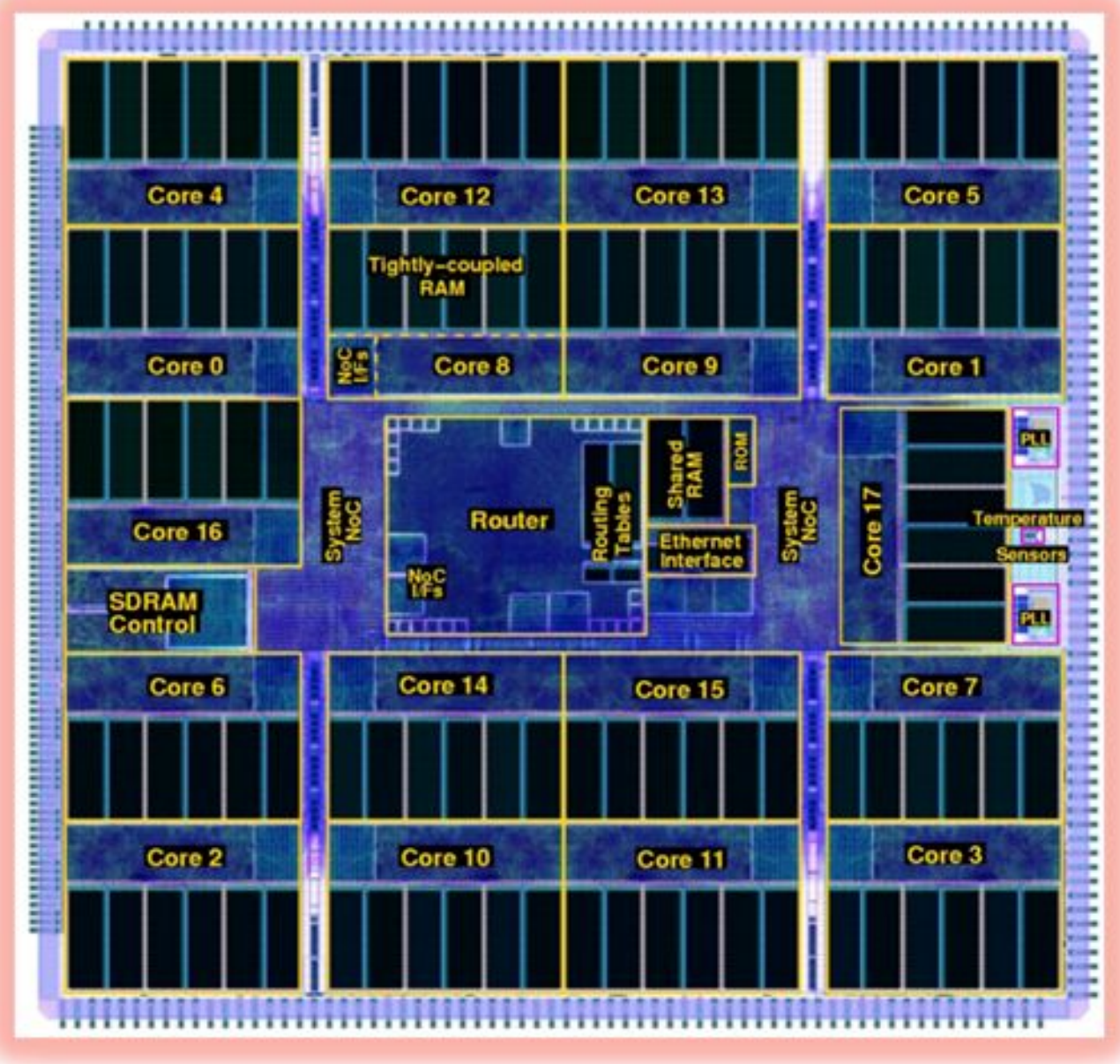
EPSRC

SpiNNaker

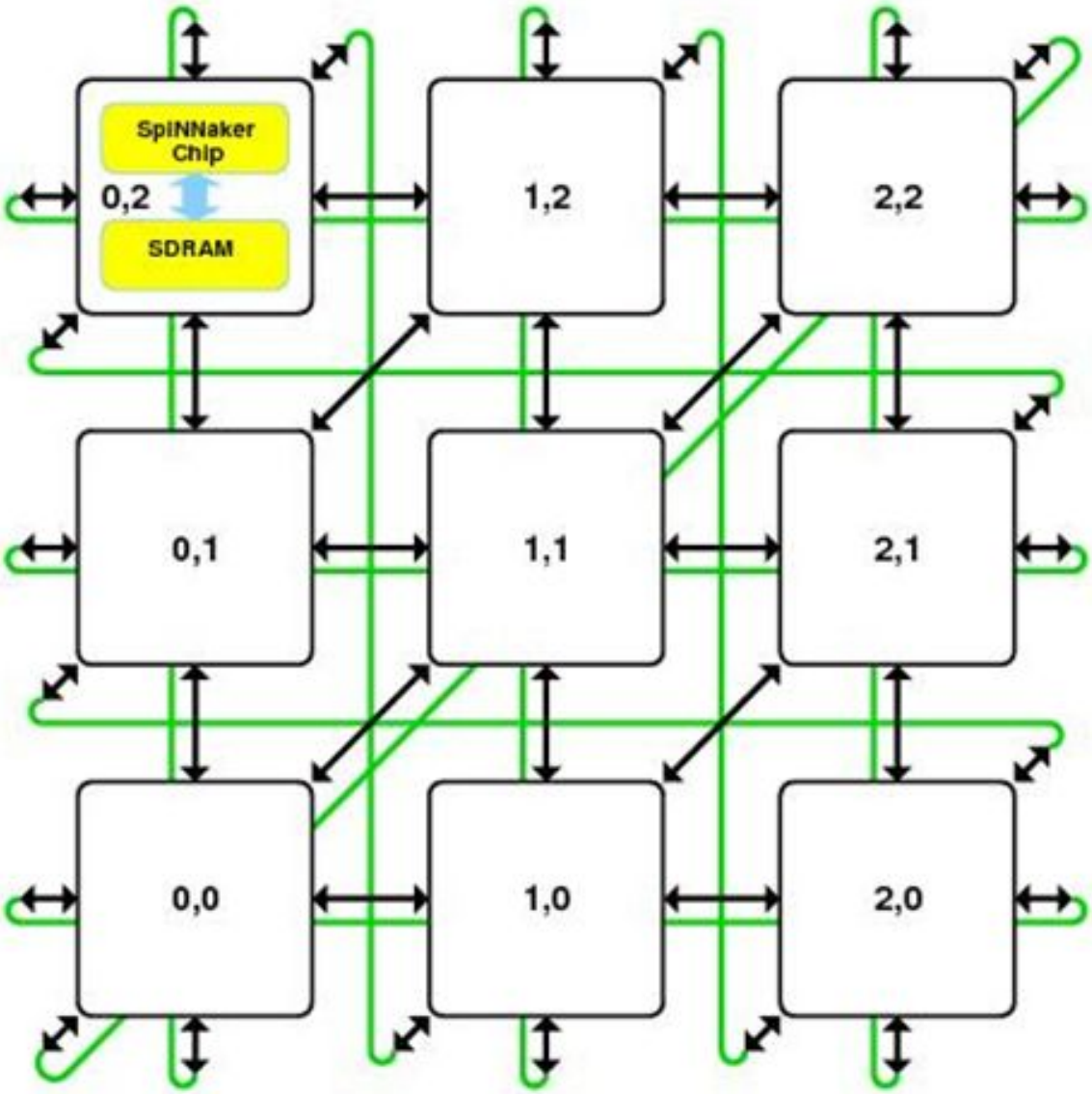
Overview

- SpiNNaker
- Summary of tools to date
- PACMAN Work Flows
  - External Algorithm Support
- PyNN Front End New Features
  - Repeated Runs and Reset
  - Closed Loop Simulations
- The Graph Front End
- Coming Soon!

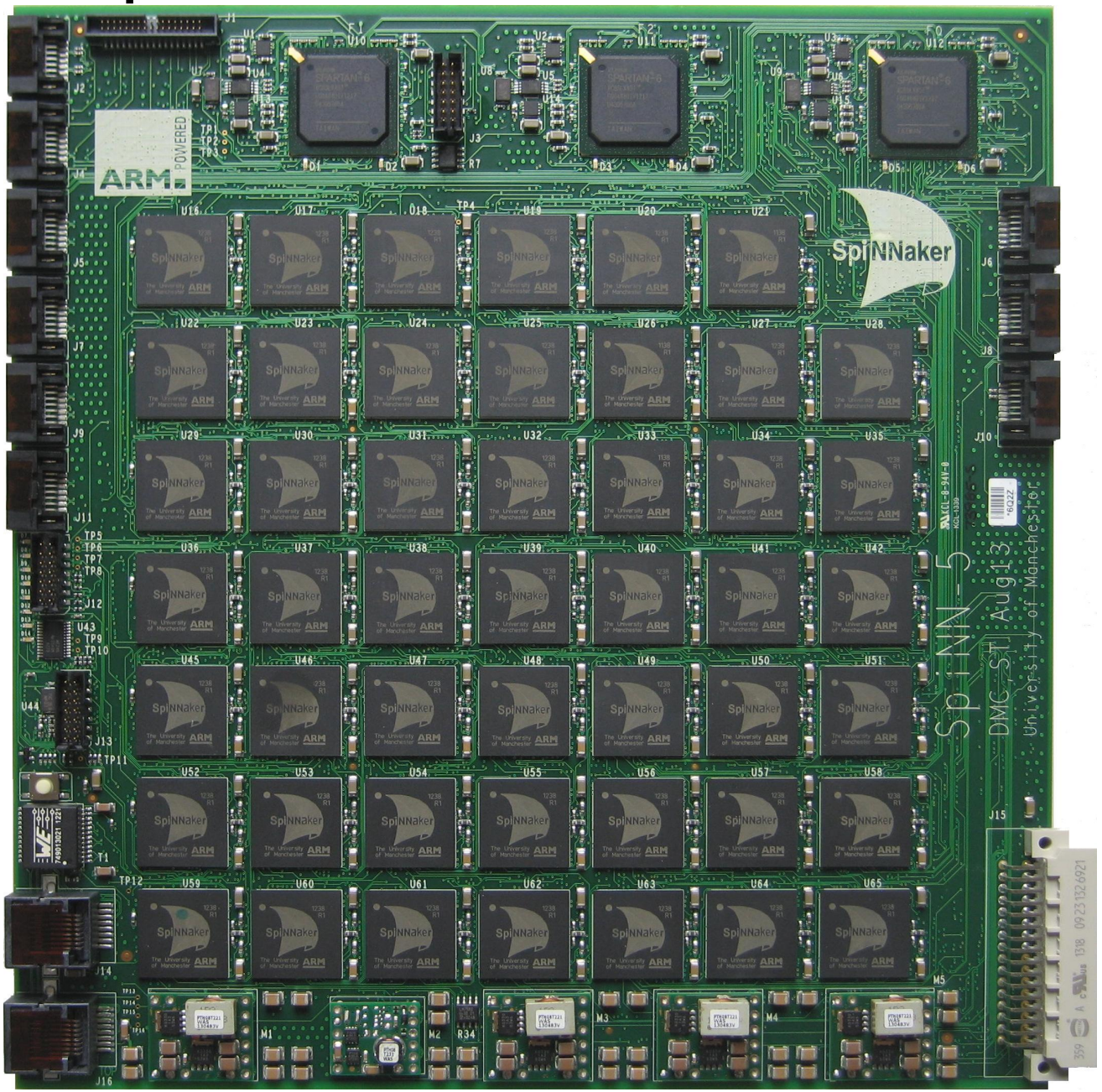
SpiNNaker


Core 4
Core 12
Core 13
Core 5
Tightly-coupled RAM
Core 0
NoC I/Fs
Core 8
Core 9
Core 1
Core 16
System NoC
Router
Routing Tables
Shared RAM
ROM
Ethernet Interface
System NoC
Core 17
PLL
Temperature Sensors
PLL
SDRAM Control
NoC I/Fs
Core 6
Core 14
Core 15
Core 7
Core 2
Core 10
Core 11
Core 3

SpiNNaker



SpiNNaker

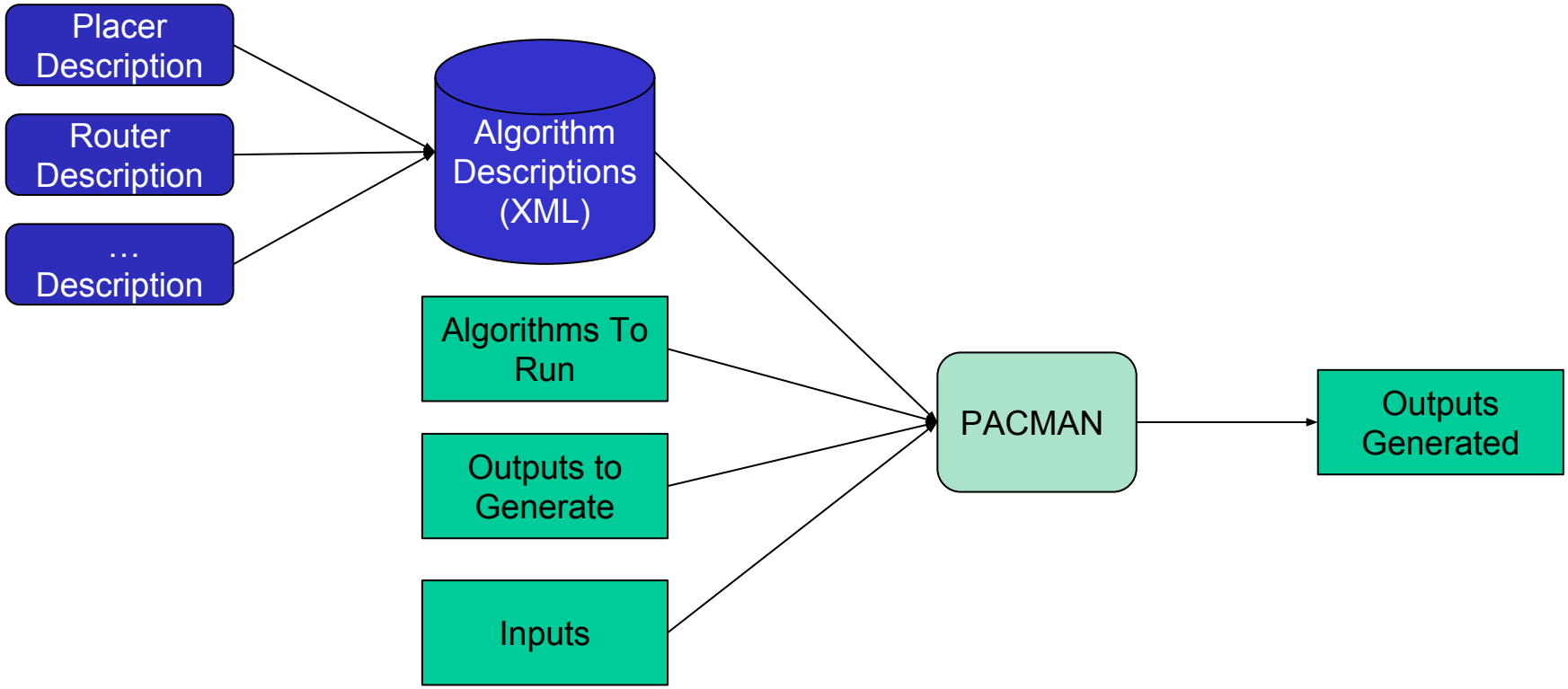

SpiNNaker
ARM
POWERED
SpiNNaker
The University of Manchester
ARM
SpiNN-5
DMC ST Aug 13
University of Manchester

SpiNNaker

Tools Summary

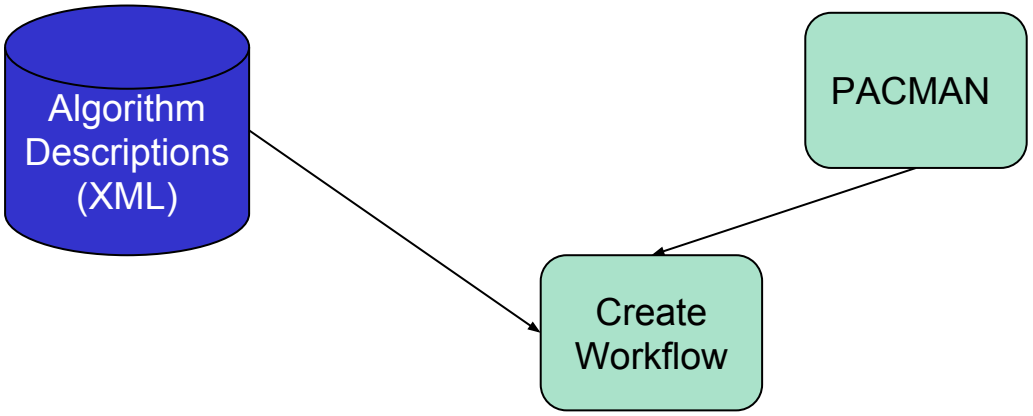
- Previous releases:
  - Just Testing April 2014
  - Little Rascal April 2015
  - Arbitrary September 2015
- Arbitrary functionality:
  - Basic PyNN 0.7 functionality
  - Live closed-loop functionality
- Hope to make next release soon after HBP codeJam #7
  - With merged achievements from the hackathon.

PACMAN Work Flows - 1 of 10



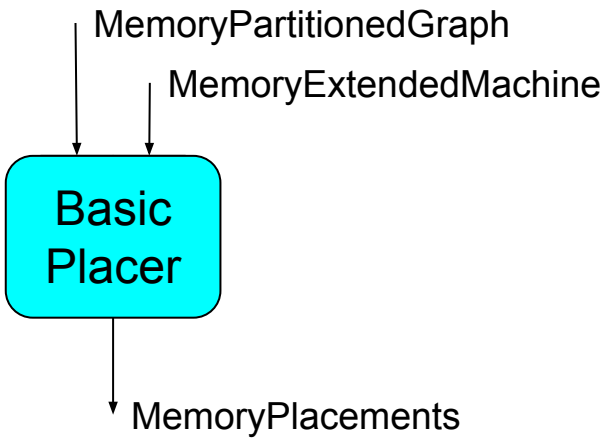
http://spinnakermanchester.github.io/2015.006.AnotherFineProductFromTheNonsenseFactory/MappingAlgorithms.html

PACMAN Work Flows - 2 of 10



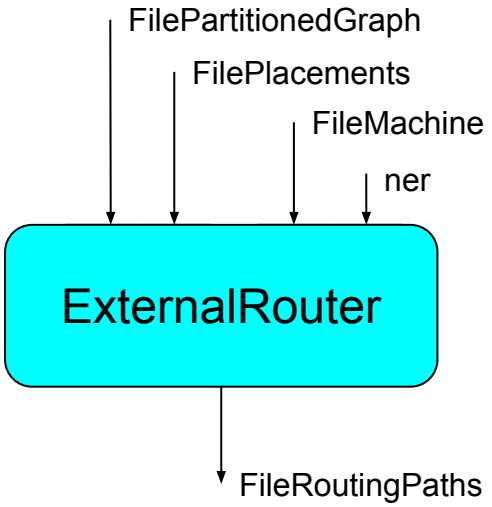
PACMAN Work Flows - 3 of 10
PACMAN Algorithm XML

```
<algorithms>
  <algorithm name="BasicPlacer">
    <python_module>pacman.operations.placer_algorithms.basic_placer</python_module>
    <python_class>BasicPlacer</python_class>
    <required_inputs>
      <parameter>
        <param_name>partitioned_graph</param_name>
        <param_type>MemoryPartitionedGraph</param_type>
      </parameter>
      <parameter>
        <param_name>machine</param_name>
        <param_type>MemoryExtendedMachine</param_type>
      </parameter>
    </required_inputs>
    <produces_outputs>
      <parameter>
        <param_name>placements</param_name>
        <param_type>MemoryPlacements</param_type>
      </parameter>
    </produces_outputs>
  </algorithm>
</algorithms>
```

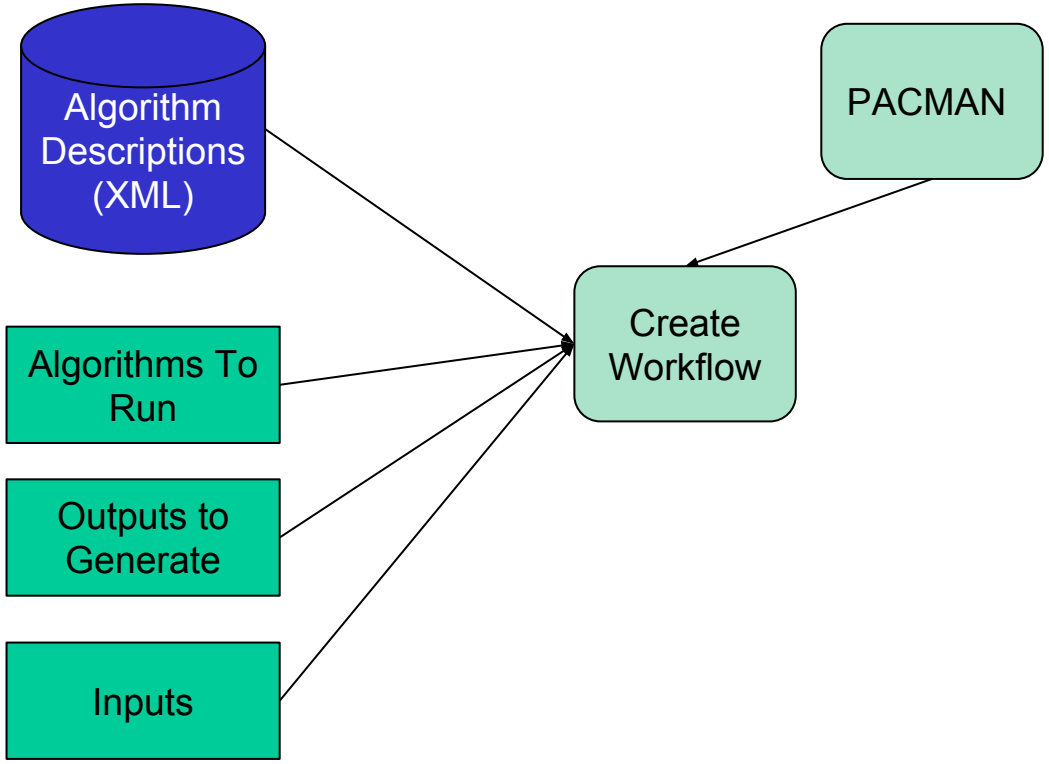


PACMAN Work Flows - 4 of 10
External Algorithm XML

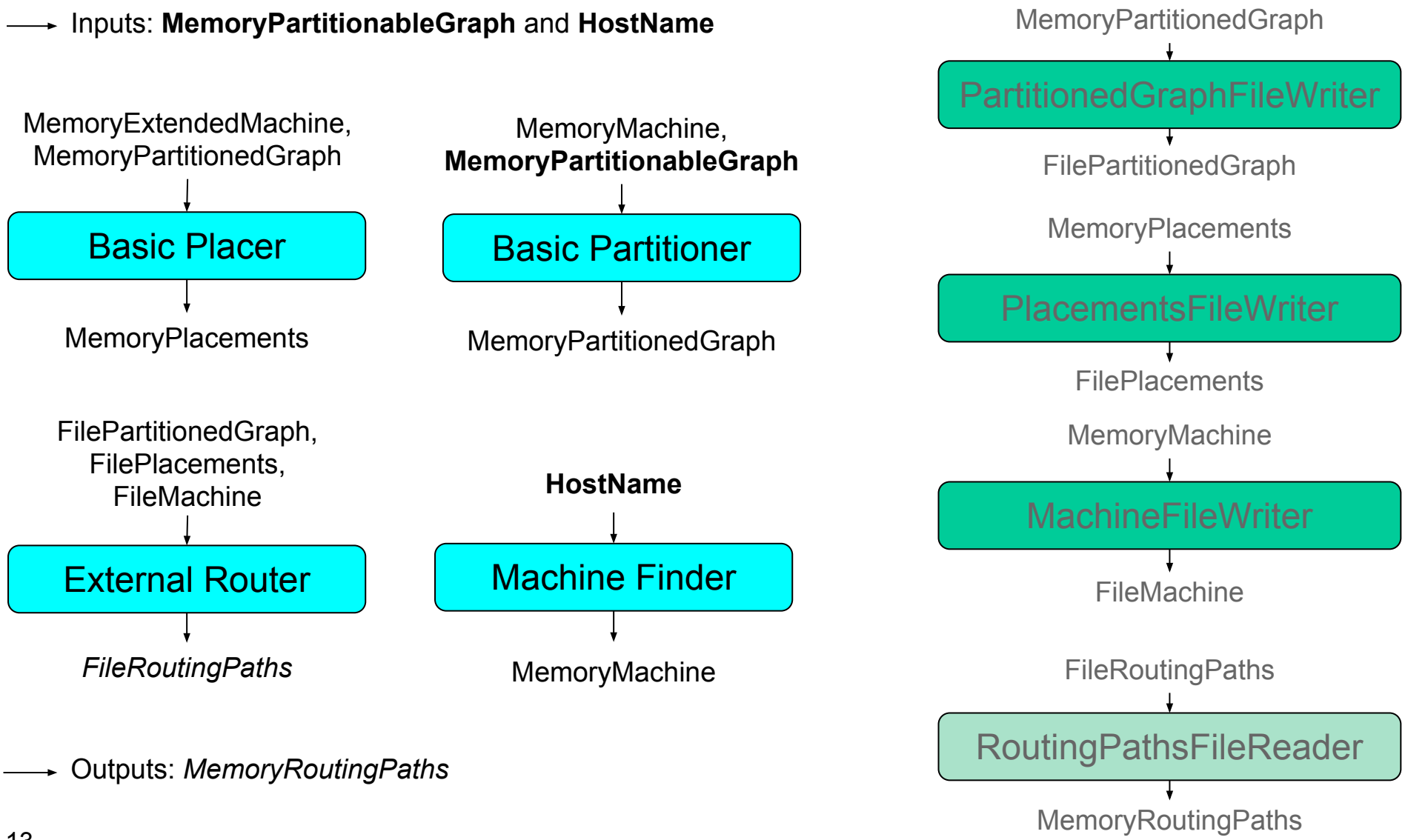
```
<algorithms>
  <algorithm name="ExternalRouter">
    <command_line_args>
      <arg>run_router.py</arg>
      <arg>--graph={graph}</arg>
      <arg>--machine={machine}</arg>
      <arg>--placements={placements}</arg>
      <arg>--algorithm=ner</arg>
    </command_line_args>
    <required_inputs>
      <parameter>
        <param_name>graph</param_name>
        <param_type>FilePartitionedGraph</param_type>
      </parameter>
      <parameter>
        <param_name>machine</param_name>
        <param_type>FileMachine</param_type>
      </parameter>
      <parameter>
        <param_name>placements</param_name>
        <param_type>FilePlacements</param_type>
      </parameter>
    </required_inputs>
    <produces_outputs>
      <parameter>
        <param_name>FileRouingPathsFilePath</param_name>
        <param_type>FileRoutingPaths</param_type>
      </parameter>
    </produces_outputs>
  </algorithm>
</algorithms>
```



PACMAN Work Flows - 5 of 10

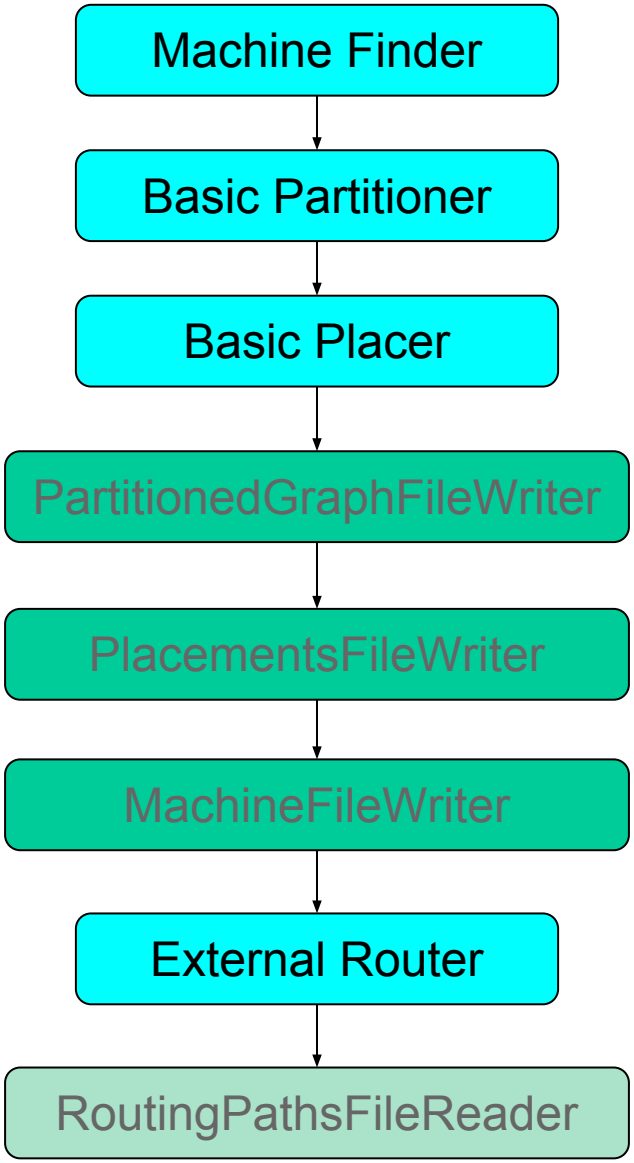


PACMAN Work Flows - 6 of 10
PACMAN Work Flow

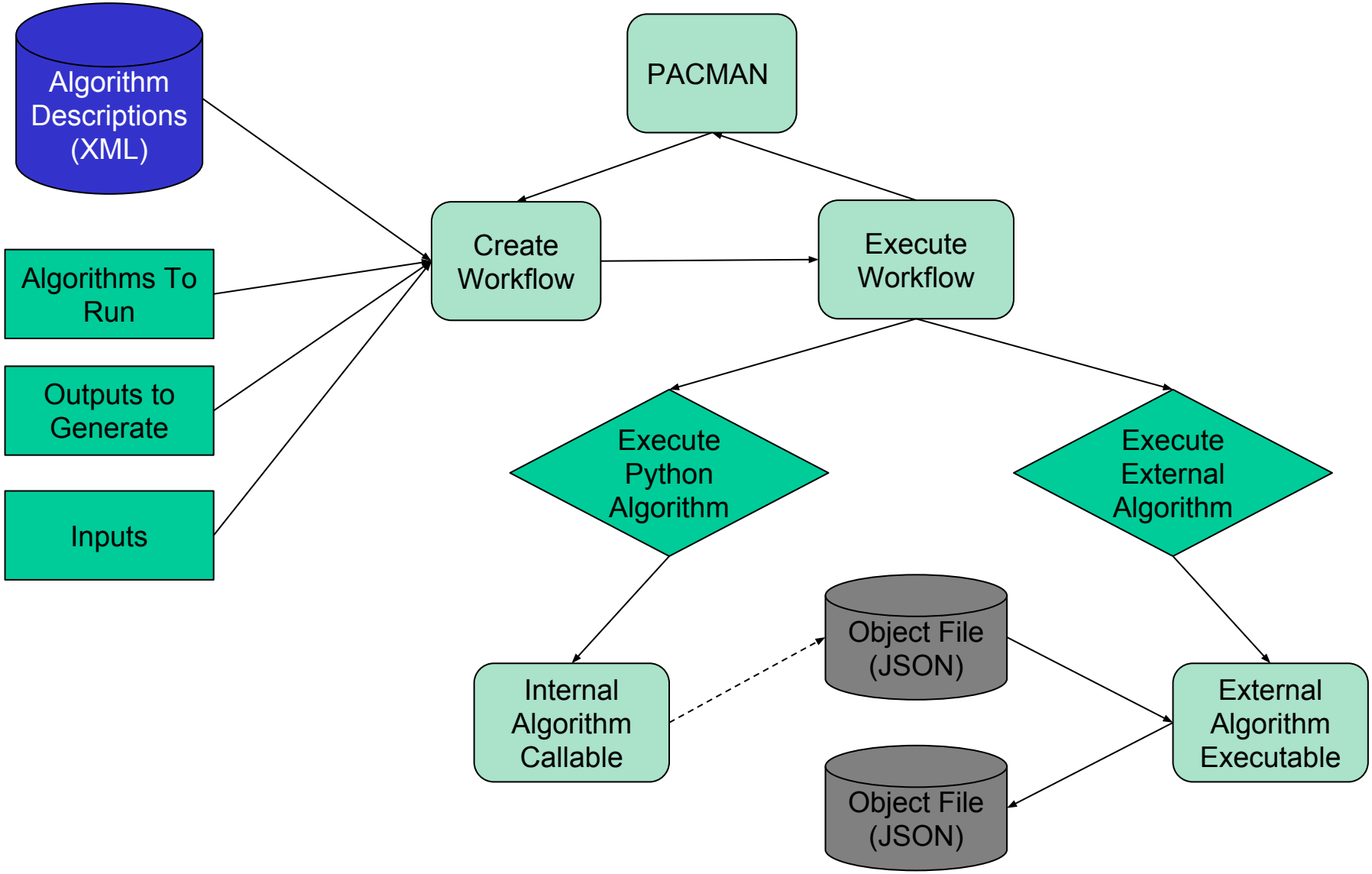


PACMAN Work Flows - 7 of 10

PACMAN Work Flow



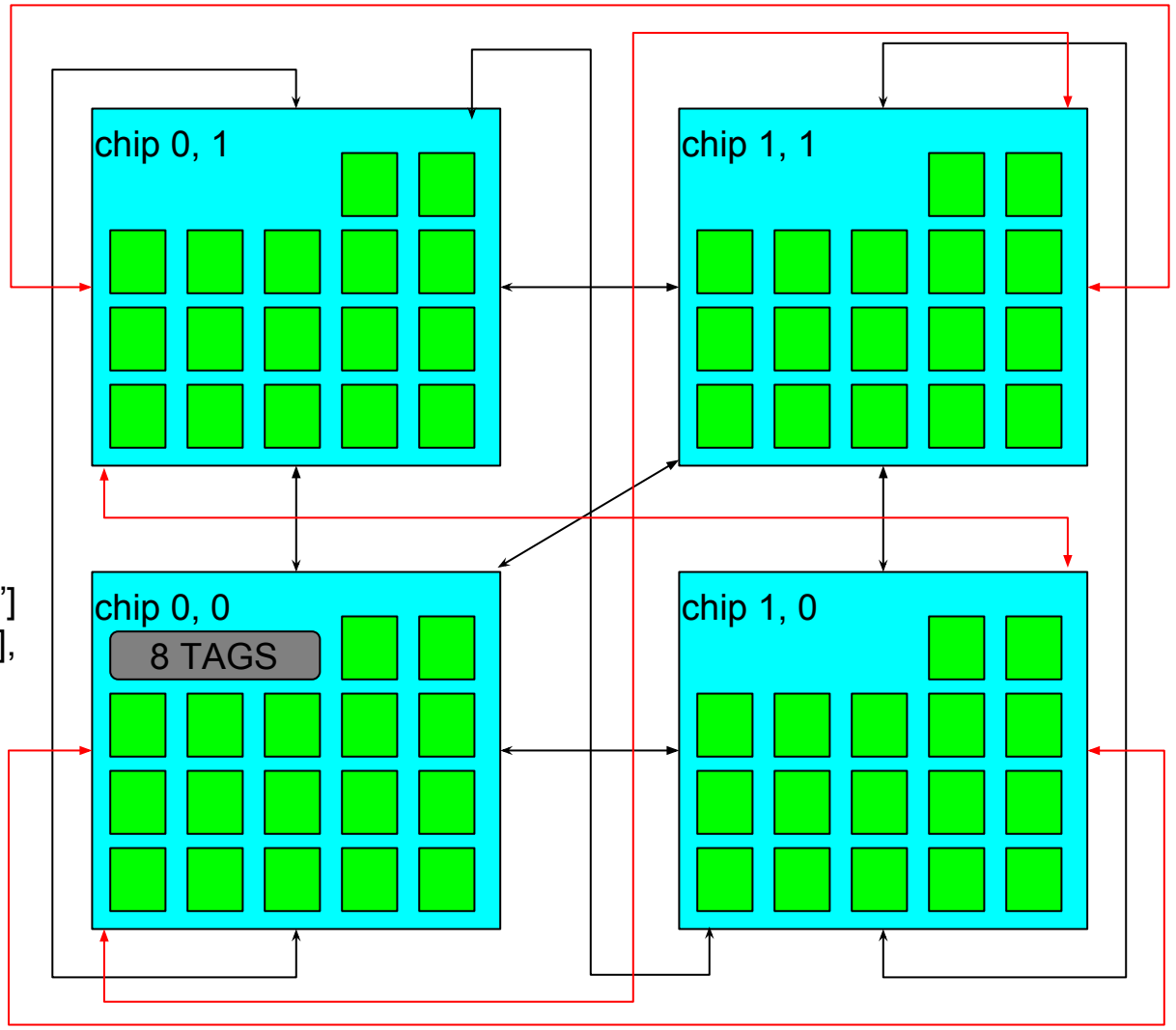
PACMAN Work Flows - 8 of 10



https://github.com/mossblaser/place-and-route-interchange-format

PACMAN Work Flows - 9 of 10
JSON Files: machine.json

```
{
"width": 2,
"height": 2,
"chip_resources":
   {
      "cores": 17,
      "sdram": 119275520
   },
"dead_chips":
   [   ]
"dead_links":
  [
    [0, 0, “west”], [1,1, “east”],
    [0, 0, “south_west”], [1, 1, “north_east”]
    [1, 0, “north_east”], [0,1, “south_west”],
    [0, 1, “west”], [1, 0, “east”]
  ]
"chip_resource_exceptions":
  [
     [0, 0, [“tags”: 8]]
  ]
}
```

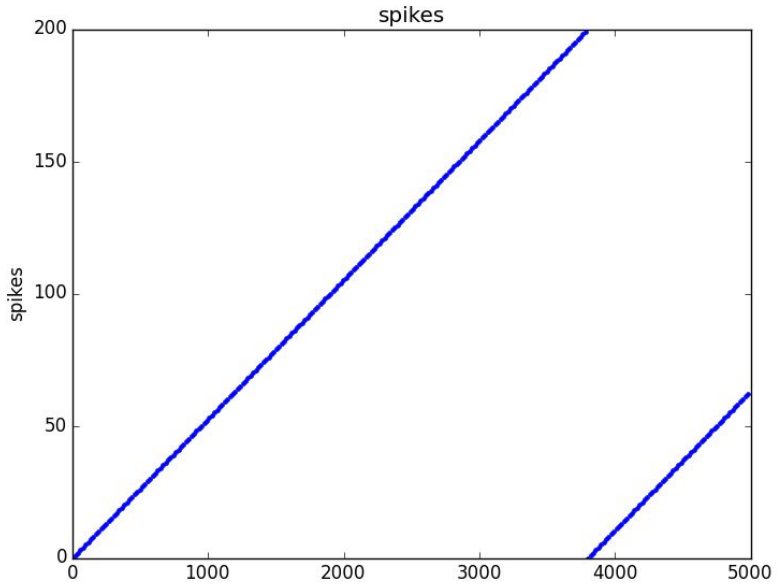


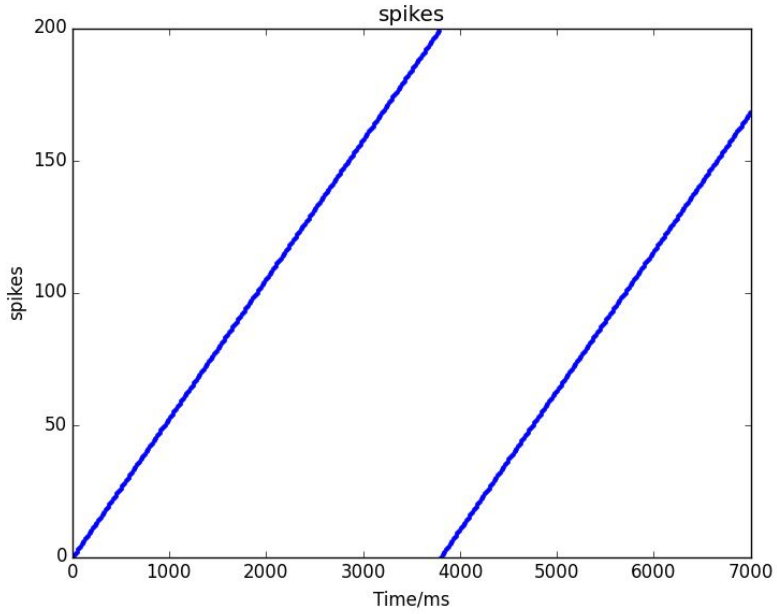
PACMAN Work Flows -10 of 10 Powering sPyNNaker

```
[Mapping]

# Name of extra algorithms to execute in workflow
algorithms = MyPlacer,MyRouter

# Path to extra algorithm description XML file(s)
extra_xml_paths = /path/to/myxml.xml
```

PyNN Front End New Functionality API calls

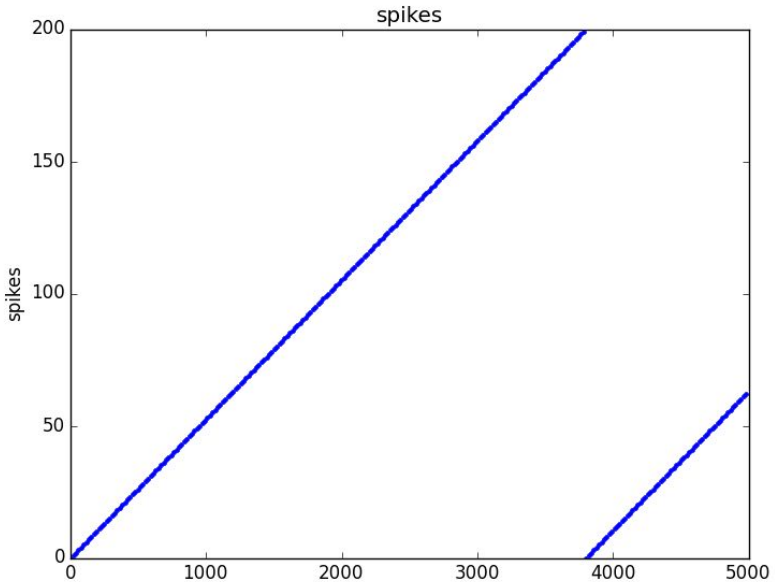
```
import pyNN.spiNNaker as p
p.setup(timestep=1.0, min_delay=1.0, max_delay=144.0)
populations = list()

# Create pops and projections for a synfire chain
…

populations[0].record()
p.run(5000)
spikes = populations[0].getSpikes()

# Plot spikes 1

p.run(2000)   <= 5000
spikes = populations[0].getSpikes()

# Plot spikes 2

p.end()
```

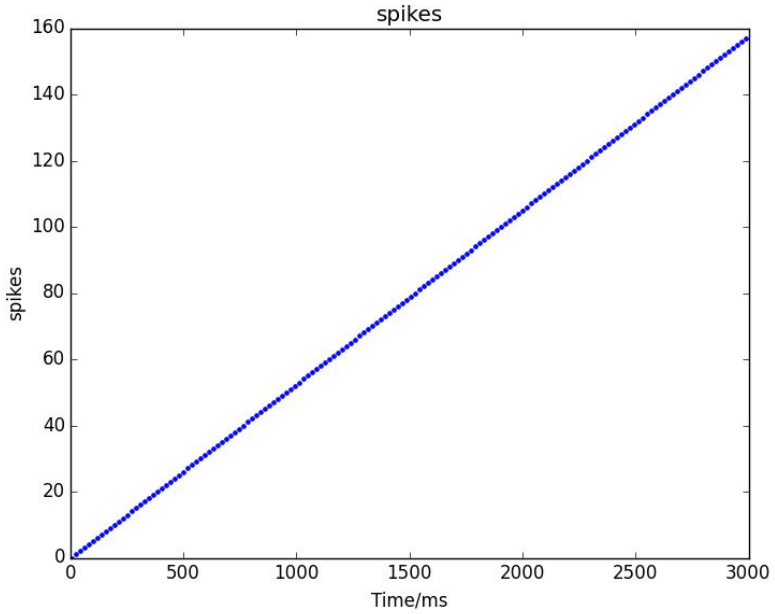




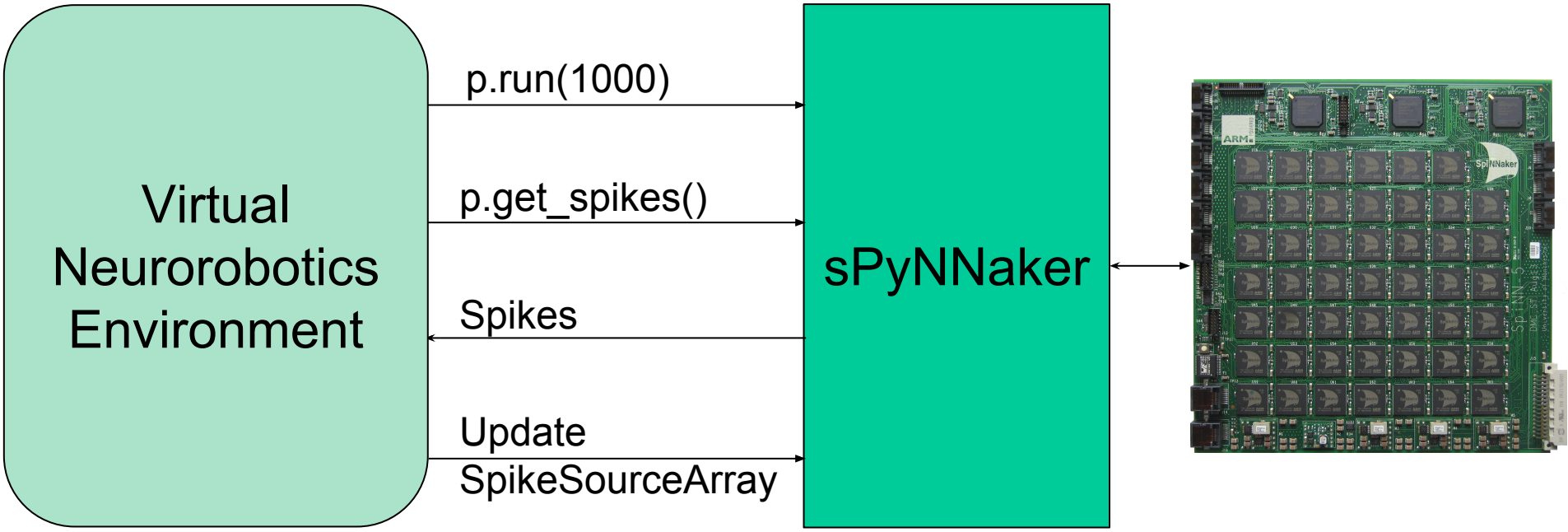
PyNN Front End New Functionality API calls

```
import pyNN.spiNNaker as p
p.setup(timestep=1.0, min_delay=1.0, max_delay=144.0)
populations = list()

# Create pops and projections for a synfire chain
…

populations[0].record()
p.run(3000)
p.run(2000)
spikes = populations[0].getSpikes()

# Plot spikes 1

p.reset()
p.run(3000) ← == 3000
spikes = populations[0].getSpikes()

# Plot spikes 2

p.end()
```

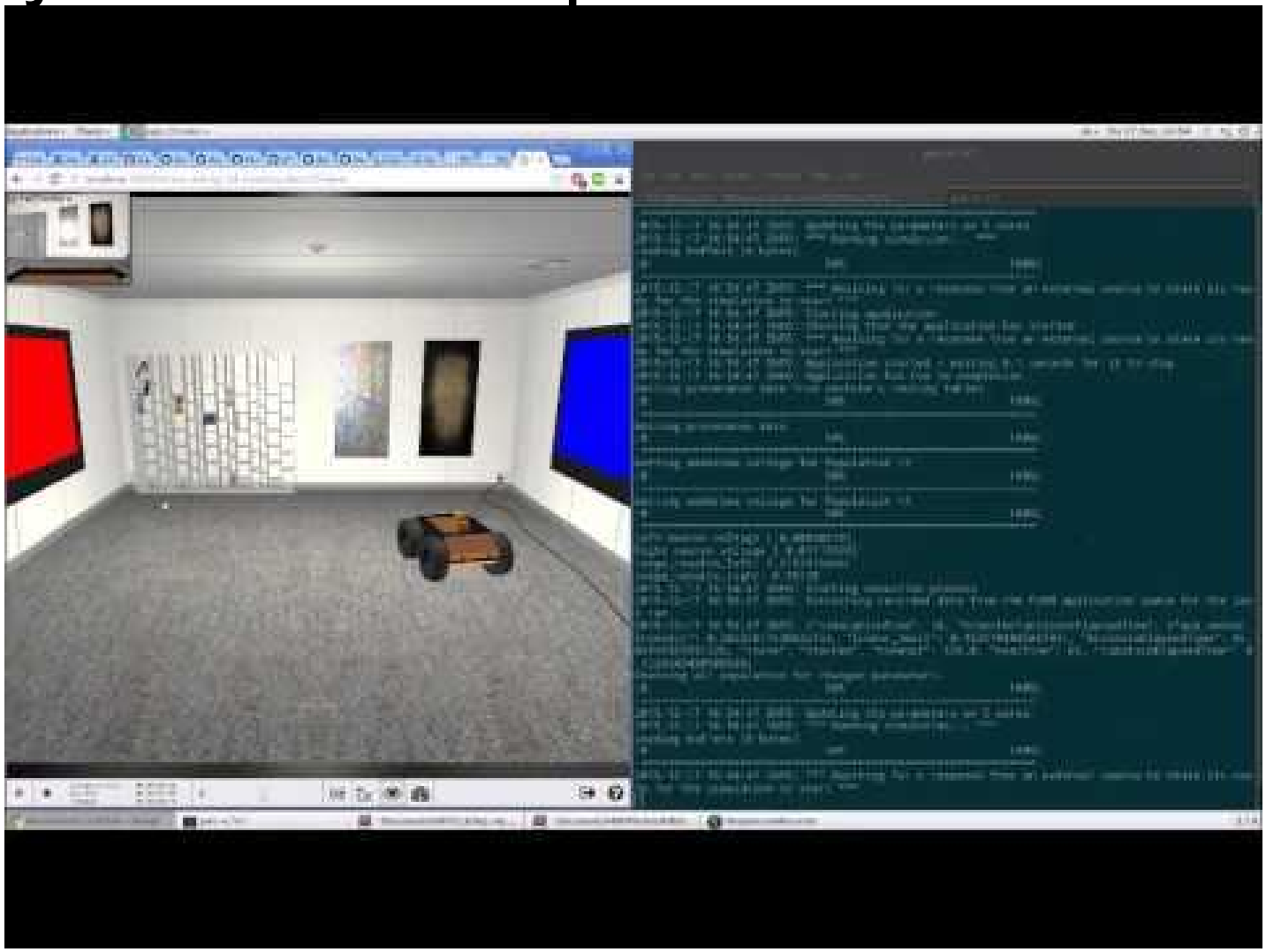




PyNN FrontEnd new functionality
Delayed closed loop simulations 1 of 2

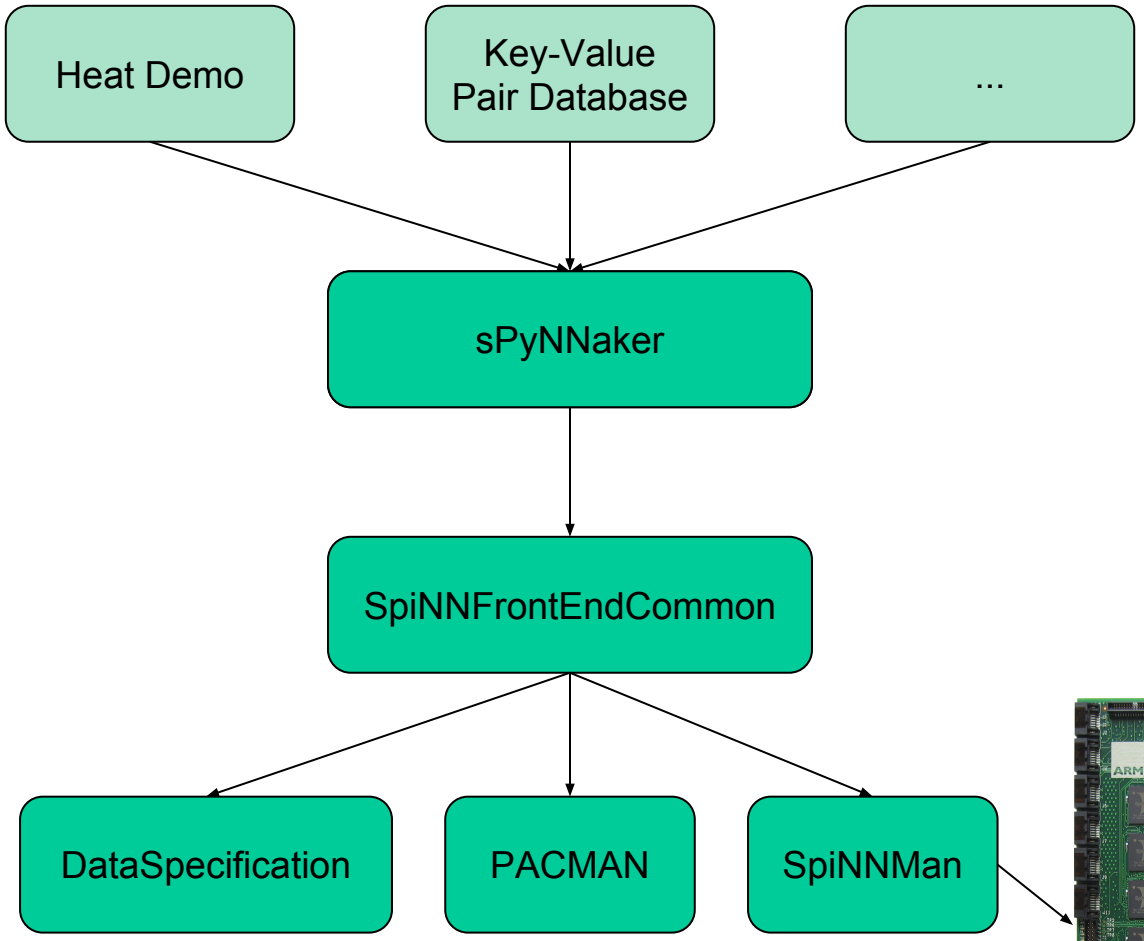


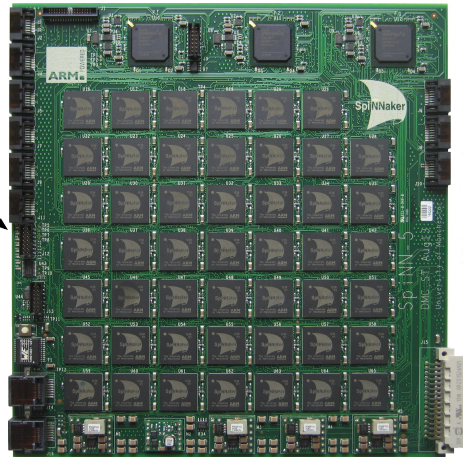
PyNN FrontEnd new functionality
Delayed closed loop simulations 2 of 2



Thanks to Felix Schneider from SP 10 for helping with this

The Graph Front End





Coming Soon!!!

1. Data expansion on chip to reduce load times.
2. Automatic pause and resume of simulation to allow recording of long running and/or large simulations on smaller machines.
3. PyNN 0.8 support.
4. Refactoring of delay representation to improve memory usage.