SpiNNaker 10^4 Machine Wiring

Generated By The 'SpiNNer' Wiring Guide Generator

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Contents

1 Introduction

This is an automatically generated wiring guide for a SpiNNaker system. This document covers a system with the basic parameters listed in Table 1.

Parameter	Value	Unit
Width	2	Threeboards
Height	2	Threeboards
Compress Direction	Rows	
Number of Folds	2	X-Axis
Number of Folds	1	Y-Axis
Cabinets	1	
Racks per Cabinet	1	
Slots per Rack	12	

Table 1: Basic Machine Parameters

1.1 About This Guide

Much of this document is based on a *'Summary of Building a Toroid using Hexagons'* by Simon Davidson and through conversations and emails with, amongst others, Simon and Steve Furber.

2 Wiring Metrics

Axis	Total Wires	Staying In-Rack	Between Racks	Between Cabinets
North	12	12	0	0
East	12	12	0	0
South West	12	12	0	0
Total	36	36	0	0

Table 2: Wire counts within racks. Note: 'Between Racks' counts wires which only leave the rack but stay in the same cabinet.

Axis	Length (m)	Number of Wires
North	$0.00 < l \leq 0.06$	9
	$0.06 < l \leq 0.09$	1
	$0.09 < l \leq 0.12$	1
	$0.12 < l \leq 0.15$	0
	$0.15 < l \leq 0.18$	1
East	$0.00 < l \leq 0.04$	1
	$0.04 < l \leq 0.06$	6
	$0.06 < l \leq 0.08$	0
	$0.08 < l \leq 0.10$	3
	$0.10 < l \leq 0.11$	2
South West	$0.00 < l \leq 0.06$	2
	$0.06 < l \leq 0.07$	3
	$0.07 < l \leq 0.09$	0
	$0.09 < l \leq 0.11$	6
	$0.11 < l \leq 0.13$	1

Table 3: Lengths of wires in the system based on given cabinet measurements. Note: no slack is given to any of the wires.

3 Topology Metrics

Note: A wiring loop is the loop taken by following wires of a given direction in a system (see Figure 1). A packet loop is the loop taken by following the path of a packet within the system (see Figure 2). All displayed values found by simulation in a model.

Property	Value	Unit
Width	2	Threeboards
Height	2	Threeboards
Width	4	Boards
Height	3	Boards
Wiring Loop North Length	6	Wires
Wiring Loop East Length	6	Wires
Wiring Loop South West Length	6	Wires
Packet Loop North Length	24	Chips
Packet Loop East Length	24	Chips
Packet Loop South West Length	24	Chips

Table 4: Overview of properties of the system.

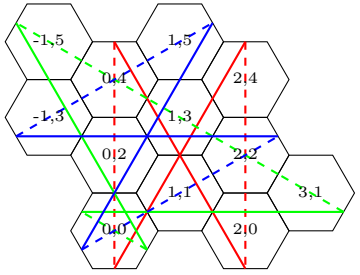

Figure 1: Example wiring loops from (0,0). Solid lines are wires, dashed lines are paths through a board. Colour key: North, East, South West.

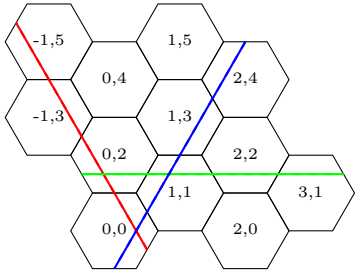

Figure 2: Example packet loops from (0,2), (1,1) and (0,0) for North, East, South West. Solid lines are wires, dashed lines are paths through a board.

4 Development of Board Placement

Boards must be placed in the physical world such that the maximum wire-length is kept short. The following development describes how the boards are placed in a physical system.

The system schematically looks like Figure 3. All touching boards have a link between them. Links to non-adjacent boards are shown using coloured lines.

All boards left of $(0, 0)$ (shown by a dashed line) are shifted to the right yielding a rectangle as shown in Figure 4.

Before continuing, the 'wobble' between consecutive columns is removed to form a regular grid as shown in Figure 5. This regular grid is then folded into 2 sheets horizontally and 1 sheet vertically along the lines shown in Figure 6.

After folding, the nodes from overlapping folds are interleaved to yield the arrangement in Figure 7. This diagram is shown with gaps dividing the nodes into 1 cabinet containing 1 rack each.

The rows of nodes in the blocks allocated to each rack are then interleaved to allocate them to a slot resulting a final slot allocation for each board. A scale-drawing of the system as assigned to cabinets is given in Figure 8.

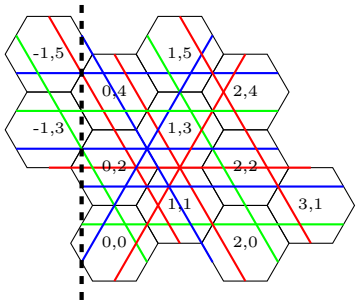

Figure 3: Schematic representation of a torus of boards. Nodes to the left of the dashed line will be shifted right in the next step. Wire colour key: North, East, South West

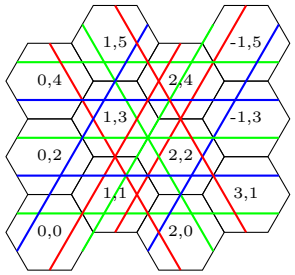

Figure 4: Rectangular arrangement of nodes. Colour key: North, East, South West

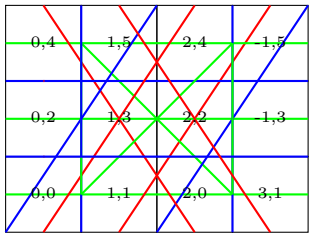

Figure 5: Nodes forced into a regular, rectangular grid. Colour key: North, East, South West

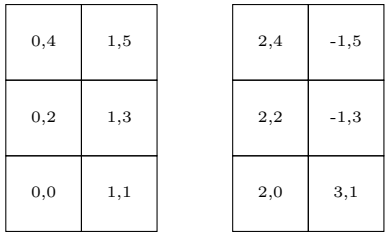

Figure 6: Lines along which the grid will be folded (wires removed for clarity).

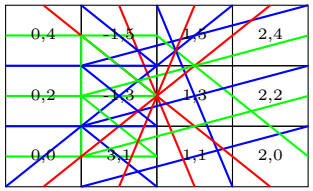

Figure 7: Arrangement after folding and interleaving shown divided into cabinets/racks. Colour key: North, East, South West

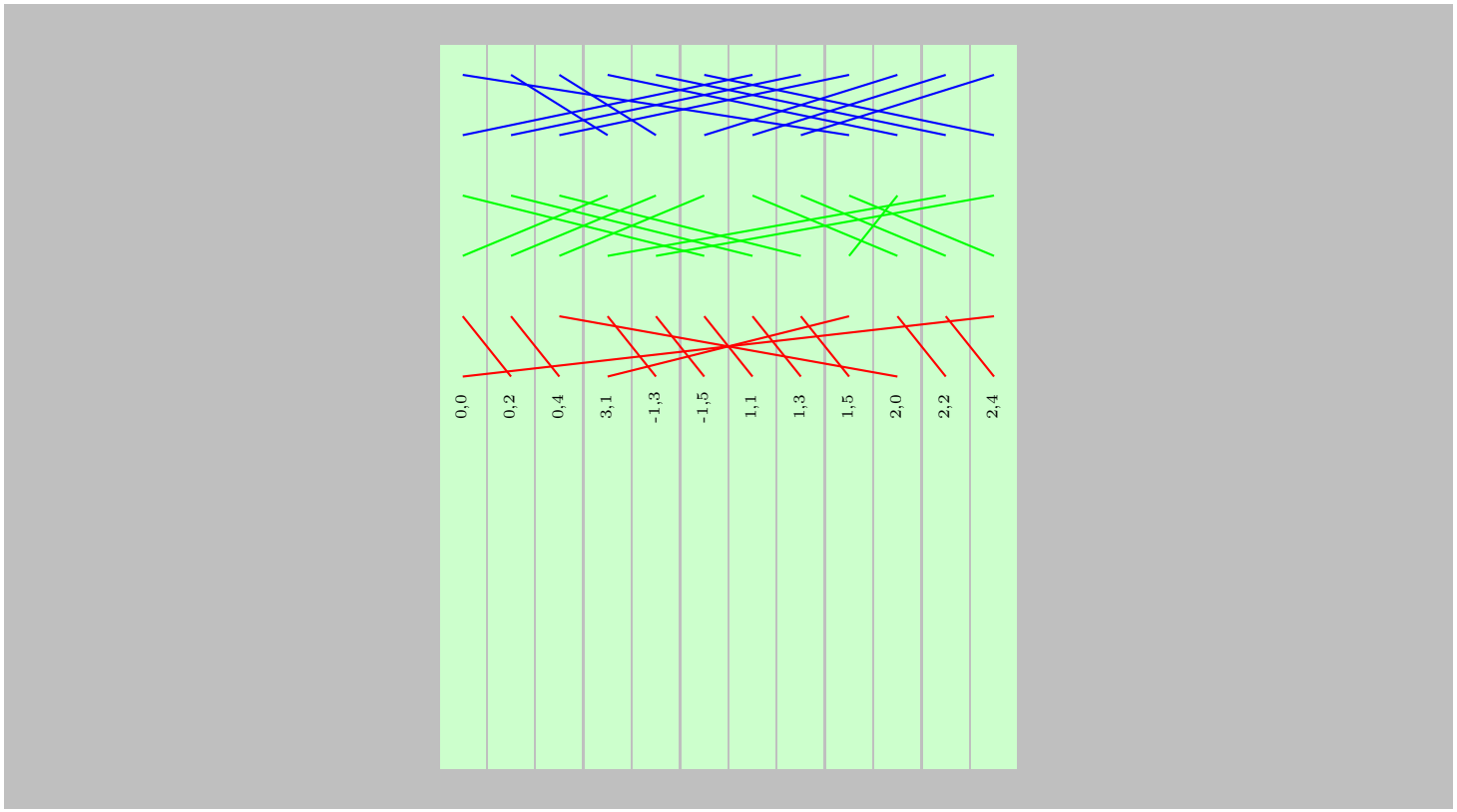

Figure 8: Allocation of SpiNNaker boards to cabinets and racks and the wires between them. Colour key: North, East, South West

5 Board Position List

The following table lists the location of each logical (hexagonal) board address in the cabinet system.

Coordinate	Cabinate	Rack	Slot
(-1,3)	0	0	4
(-1,5)	0	0	5
(0,0)	0	0	0
(0,2)	0	0	1
(0,4)	0	0	2
(1,1)	0	0	6
(1,3)	0	0	7
(1,5)	0	0	8
(2,0)	0	0	9
(2,2)	0	0	10
(2,4)	0	0	11
(3,1)	0	0	3

6 Wiring Instructions

This series of tables lists connections which need to be made in the system. Wiring is listed first for wires within a cabinet, then between racks, then between cabinets.

6.1 Wires Within Racks

6.1.1 Cabinet 0, Rack 0

From					To			
Cab.	Rack	Slot	Socket	→	Cab.	Rack	Slot	Socket
0	0	0	J1 (SW)	→	0	0	8	J2 (NE)
0	0	0	J2 (NE)	→	0	0	6	J1 (SW)
0	0	0	J3 (E)	→	0	0	5	J4 (W)
0	0	0	J4 (W)	→	0	0	3	J3 (E)
0	0	0	J5 (N)	→	0	0	1	J6 (S)
0	0	0	J6 (S)	→	0	0	11	J5 (N)
0	0	1	J1 (SW)	→	0	0	3	J2 (NE)
0	0	1	J2 (NE)	→	0	0	7	J1 (SW)
0	0	1	J3 (E)	→	0	0	6	J4 (W)
0	0	1	J4 (W)	→	0	0	4	J3 (E)
0	0	1	J5 (N)	→	0	0	2	J6 (S)
0	0	2	J1 (SW)	→	0	0	4	J2 (NE)
0	0	2	J2 (NE)	→	0	0	8	J1 (SW)
0	0	2	J3 (E)	→	0	0	7	J4 (W)
0	0	2	J4 (W)	→	0	0	5	J3 (E)
0	0	2	J5 (N)	→	0	0	9	J6 (S)

From					To			
Cab.	Rack	Slot	Socket	→	Cab.	Rack	Slot	Socket
0	0	3	J1 (SW)	→	0	0	9	J2 (NE)
0	0	3	J4 (W)	→	0	0	10	J3 (E)
0	0	3	J5 (N)	→	0	0	4	J6 (S)
0	0	3	J6 (S)	→	0	0	8	J5 (N)
0	0	4	J1 (SW)	→	0	0	10	J2 (NE)
0	0	4	J4 (W)	→	0	0	11	J3 (E)
0	0	4	J5 (N)	→	0	0	5	J6 (S)
0	0	5	J1 (SW)	→	0	0	11	J2 (NE)
0	0	5	J2 (NE)	→	0	0	9	J1 (SW)
0	0	5	J5 (N)	→	0	0	6	J6 (S)
0	0	6	J2 (NE)	→	0	0	10	J1 (SW)
0	0	6	J3 (E)	→	0	0	9	J4 (W)
0	0	6	J5 (N)	→	0	0	7	J6 (S)
0	0	7	J2 (NE)	→	0	0	11	J1 (SW)
0	0	7	J3 (E)	→	0	0	10	J4 (W)
0	0	7	J5 (N)	→	0	0	8	J6 (S)
0	0	8	J3 (E)	→	0	0	11	J4 (W)
0	0	8	J4 (W)	→	0	0	9	J3 (E)
0	0	9	J5 (N)	→	0	0	10	J6 (S)
0	0	10	J5 (N)	→	0	0	11	J6 (S)