Reachability Graph Statistics

This report has been generated by helena.

General information

Model analyzed	load_balancer
Model language	Helena
Model parameters	C = 6
	S = 2
Analysis date	November, 30, 2017 at 09:30:10
File path	`/home/sami/git/helena/examples/load_balancer.lna`

Size information

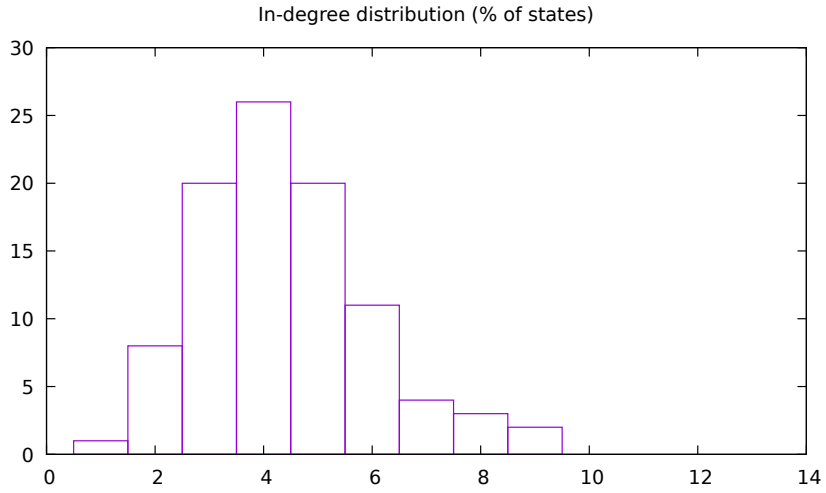
States	673814
Edges	3031863

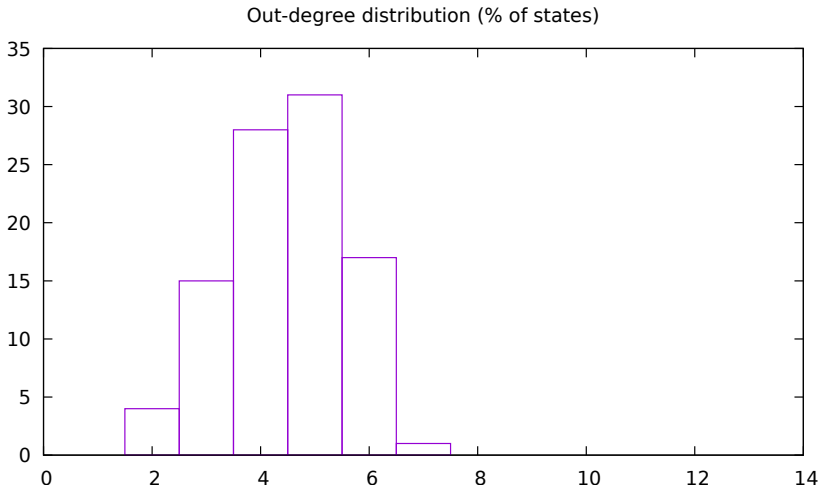
Strongly connected components (SCC) information

Number of components	1
Number of trivial components	0
Number of terminal components	1
Size of the largest component	673814

Degrees information

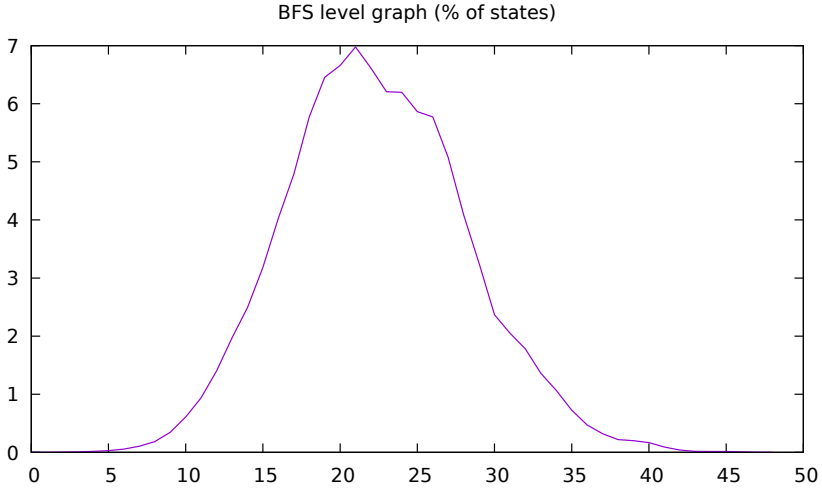
Average degree	4.4996
Maximal in-degree	13
Maximal out-degree	9

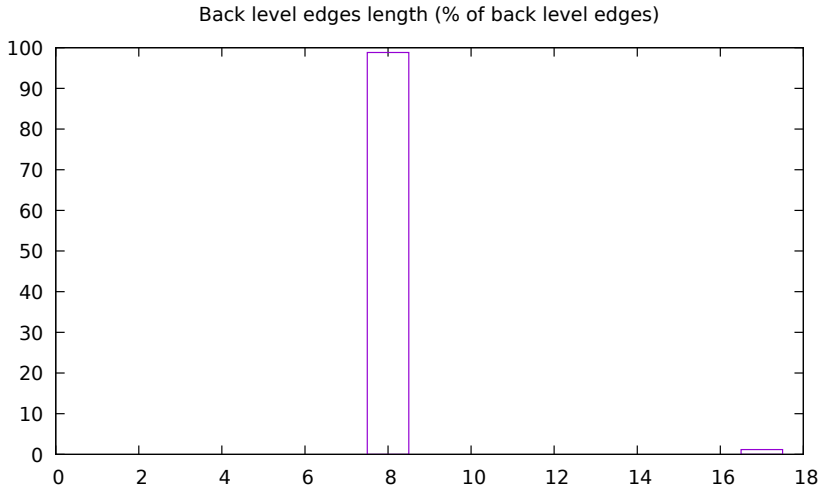




BFS information

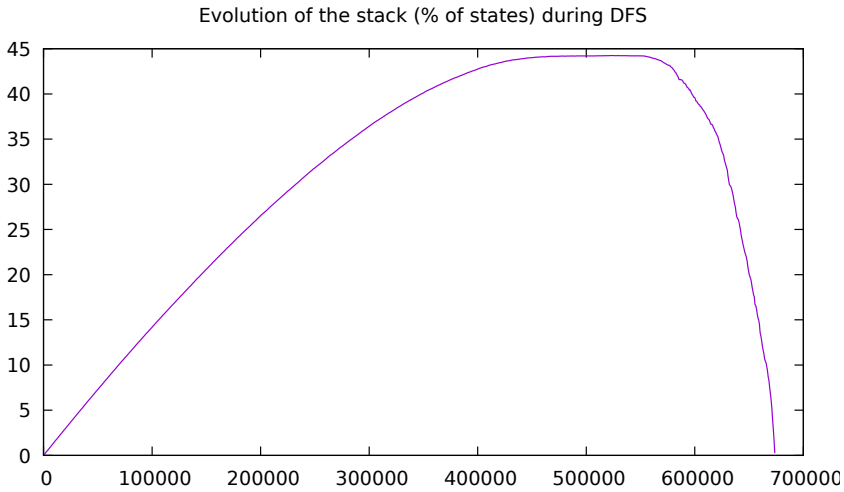
Levels	49	
Back level edges	605686	(19.98%)
Width	47016	(6.98%)
Max back level edge length	17	
Average back level edge length	8.11	





DFS information

Max stack size	298158
Front edges	673813
Back edges	986293
Cross edges	1371757
Shortest cycle	9



Place bounds

	Min. cardinality	Max. cardinality	Min. multiplicity	Max. multiplicity
client_idle	0	6	0	6
client_waiting	0	6	0	6
client_request	0	6	0	6
client_ack	0	6	0	6
server_idle	0	2	0	2
server_waiting	0	2	0	2
server_processing	0	2	0	2
server_notification	0	2	0	2
server_notification_ack	0	2	0	2
server_request	0	6	0	6
balancer_idle	0	1	0	1
balancer_routing	0	1	0	1
balancer_balancing	0	1	0	1

Dead markings

Number of dead reachable marking(s): 0

Possible tokens

- 6 possible token(s) in place client_idle

<(1)>
<(2)>
<(3)>
<(4)>
<(5)>
<(6)>

- 6 possible token(s) in place client_waiting

  <(1)>
  <(2)>
  <(3)>
  <(4)>
  <(5)>
  <(6)>

- 6 possible token(s) in place client_request

  <(1)>
  <(2)>
  <(3)>
  <(4)>
  <(5)>
  <(6)>

- 6 possible token(s) in place client_ack

  <(1)>
  <(2)>
  <(3)>
  <(4)>
  <(5)>
  <(6)>

- 2 possible token(s) in place server_idle

  <(1)>
  <(2)>

- 12 possible token(s) in place server_waiting

  <(1, 1)>
  <(1, 2)>
  <(1, 3)>
  <(1, 4)>
  <(1, 5)>
  <(1, 6)>
  <(2, 1)>
  <(2, 2)>
  <(2, 3)>
  <(2, 4)>
  <(2, 5)>
  <(2, 6)>

- 12 possible token(s) in place server_processing

  <(1, 1)>
  <(1, 2)>
  <(1, 3)>

<(1, 4)>
<(1, 5)>
<(1, 6)>
<(2, 1)>
<(2, 2)>
<(2, 3)>
<(2, 4)>
<(2, 5)>
<(2, 6)>

- 2 possible token(s) in place server_notification

<(1)>
<(2)>

- 2 possible token(s) in place server_notification_ack

<(1)>
<(2)>

- 12 possible token(s) in place server_request

<(1, 1)>
<(1, 2)>
<(2, 1)>
<(2, 2)>
<(3, 1)>
<(3, 2)>
<(4, 1)>
<(4, 2)>
<(5, 1)>
<(5, 2)>
<(6, 1)>
<(6, 2)>

- 10 possible token(s) in place balancer_idle

<([0, 0])>
<([0, 1])>
<([1, 0])>
<([1, 1])>
<([1, 2])>
<([2, 1])>
<([2, 2])>
<([2, 3])>
<([3, 2])>
<([3, 3])>

- 54 possible token(s) in place balancer_routing

<([0, 0], 1)>

<([0, 0], 2)>
<([0, 0], 3)>
<([0, 0], 4)>
<([0, 0], 5)>
<([0, 0], 6)>
<([0, 1], 1)>
<([0, 1], 2)>
<([0, 1], 3)>
<([0, 1], 4)>
<([0, 1], 5)>
<([0, 1], 6)>
<([1, 0], 1)>
<([1, 0], 2)>
<([1, 0], 3)>
<([1, 0], 4)>
<([1, 0], 5)>
<([1, 0], 6)>
<([1, 1], 1)>
<([1, 1], 2)>
<([1, 1], 3)>
<([1, 1], 4)>
<([1, 1], 5)>
<([1, 1], 6)>
<([1, 2], 1)>
<([1, 2], 2)>
<([1, 2], 3)>
<([1, 2], 4)>
<([1, 2], 5)>
<([1, 2], 6)>
<([2, 1], 1)>
<([2, 1], 2)>
<([2, 1], 3)>
<([2, 1], 4)>
<([2, 1], 5)>
<([2, 1], 6)>
<([2, 2], 1)>
<([2, 2], 2)>
<([2, 2], 3)>
<([2, 2], 4)>
<([2, 2], 5)>
<([2, 2], 6)>
<([2, 3], 1)>
<([2, 3], 2)>

<([2, 3], 3)>
<([2, 3], 4)>
<([2, 3], 5)>
<([2, 3], 6)>
<([3, 2], 1)>
<([3, 2], 2)>
<([3, 2], 3)>
<([3, 2], 4)>
<([3, 2], 5)>
<([3, 2], 6)>

- 13 possible token(s) in place balancer_balancing

<([0, 0])>
<([0, 1])>
<([0, 2])>
<([1, 0])>
<([1, 1])>
<([1, 2])>
<([1, 3])>
<([2, 0])>
<([2, 1])>
<([2, 2])>
<([2, 3])>
<([3, 1])>
<([3, 2])>

Liveness information

- Transition client_send

6 live bindings

[c = 1]
[c = 2]
[c = 3]
[c = 4]
[c = 5]
[c = 6]

0 quasi-live bindings

- Transition client_receive

6 live bindings

[c = 1]
[c = 2]
[c = 3]
[c = 4]
[c = 5]
[c = 6]

0 quasi-live bindings

- Transition server_notify

  12 live bindings

  [s = 1, c = 1]
  [s = 1, c = 2]
  [s = 1, c = 3]
  [s = 1, c = 4]
  [s = 1, c = 5]
  [s = 1, c = 6]
  [s = 2, c = 1]
  [s = 2, c = 2]
  [s = 2, c = 3]
  [s = 2, c = 4]
  [s = 2, c = 5]
  [s = 2, c = 6]

  0 quasi-live bindings

- Transition server_receive

  12 live bindings

  [s = 1, c = 1]
  [s = 1, c = 2]
  [s = 1, c = 3]
  [s = 1, c = 4]
  [s = 1, c = 5]
  [s = 1, c = 6]
  [s = 2, c = 1]
  [s = 2, c = 2]
  [s = 2, c = 3]
  [s = 2, c = 4]
  [s = 2, c = 5]
  [s = 2, c = 6]

  0 quasi-live bindings

- Transition server_send

  12 live bindings

  [s = 1, c = 1]
  [s = 1, c = 2]
  [s = 1, c = 3]
  [s = 1, c = 4]
  [s = 1, c = 5]
  [s = 1, c = 6]
  [s = 2, c = 1]
  [s = 2, c = 2]
  [s = 2, c = 3]
  [s = 2, c = 4]
  [s = 2, c = 5]
  [s = 2, c = 6]

  0 quasi-live bindings

- Transition balancer_receive_client

  54 live bindings

  [l = [0, 0], c = 1]
  [l = [0, 0], c = 2]
  [l = [0, 0], c = 3]
  [l = [0, 0], c = 4]
  [l = [0, 0], c = 5]
  [l = [0, 0], c = 6]
  [l = [0, 1], c = 1]
  [l = [0, 1], c = 2]
  [l = [0, 1], c = 3]
  [l = [0, 1], c = 4]
  [l = [0, 1], c = 5]
  [l = [0, 1], c = 6]
  [l = [1, 0], c = 1]
  [l = [1, 0], c = 2]
  [l = [1, 0], c = 3]
  [l = [1, 0], c = 4]
  [l = [1, 0], c = 5]
  [l = [1, 0], c = 6]
  [l = [1, 1], c = 1]
  [l = [1, 1], c = 2]
  [l = [1, 1], c = 3]
  [l = [1, 1], c = 4]
  [l = [1, 1], c = 5]
  [l = [1, 1], c = 6]
  [l = [1, 2], c = 1]
  [l = [1, 2], c = 2]
  [l = [1, 2], c = 3]
  [l = [1, 2], c = 4]
  [l = [1, 2], c = 5]
  [l = [1, 2], c = 6]
  [l = [2, 1], c = 1]
  [l = [2, 1], c = 2]
  [l = [2, 1], c = 3]
  [l = [2, 1], c = 4]
  [l = [2, 1], c = 5]
  [l = [2, 1], c = 6]
  [l = [2, 2], c = 1]
  [l = [2, 2], c = 2]
  [l = [2, 2], c = 3]
  [l = [2, 2], c = 4]
  [l = [2, 2], c = 5]
  [l = [2, 2], c = 6]
  [l = [2, 3], c = 1]
  [l = [2, 3], c = 2]
  [l = [2, 3], c = 3]
  [l = [2, 3], c = 4]

[l = [2, 3], c = 5]
[l = [2, 3], c = 6]
[l = [3, 2], c = 1]
[l = [3, 2], c = 2]
[l = [3, 2], c = 3]
[l = [3, 2], c = 4]
[l = [3, 2], c = 5]
[l = [3, 2], c = 6]

0 quasi-live bindings

- Transition balancer_route

54 live bindings

[l = [0, 0], c = 1]
[l = [0, 0], c = 2]
[l = [0, 0], c = 3]
[l = [0, 0], c = 4]
[l = [0, 0], c = 5]
[l = [0, 0], c = 6]
[l = [0, 1], c = 1]
[l = [0, 1], c = 2]
[l = [0, 1], c = 3]
[l = [0, 1], c = 4]
[l = [0, 1], c = 5]
[l = [0, 1], c = 6]
[l = [1, 0], c = 1]
[l = [1, 0], c = 2]
[l = [1, 0], c = 3]
[l = [1, 0], c = 4]
[l = [1, 0], c = 5]
[l = [1, 0], c = 6]
[l = [1, 1], c = 1]
[l = [1, 1], c = 2]
[l = [1, 1], c = 3]
[l = [1, 1], c = 4]
[l = [1, 1], c = 5]
[l = [1, 1], c = 6]
[l = [1, 2], c = 1]
[l = [1, 2], c = 2]
[l = [1, 2], c = 3]
[l = [1, 2], c = 4]
[l = [1, 2], c = 5]
[l = [1, 2], c = 6]
[l = [2, 1], c = 1]
[l = [2, 1], c = 2]
[l = [2, 1], c = 3]
[l = [2, 1], c = 4]
[l = [2, 1], c = 5]
[l = [2, 1], c = 6]
[l = [2, 2], c = 1]

[l = [2, 2], c = 2]
[l = [2, 2], c = 3]
[l = [2, 2], c = 4]
[l = [2, 2], c = 5]
[l = [2, 2], c = 6]
[l = [2, 3], c = 1]
[l = [2, 3], c = 2]
[l = [2, 3], c = 3]
[l = [2, 3], c = 4]
[l = [2, 3], c = 5]
[l = [2, 3], c = 6]
[l = [3, 2], c = 1]
[l = [3, 2], c = 2]
[l = [3, 2], c = 3]
[l = [3, 2], c = 4]
[l = [3, 2], c = 5]
[l = [3, 2], c = 6]

0 quasi-live bindings

- Transition balancer_receive_notification

16 live bindings

[l = [0, 1], s = 2]
[l = [1, 0], s = 1]
[l = [1, 1], s = 1]
[l = [1, 1], s = 2]
[l = [1, 2], s = 1]
[l = [1, 2], s = 2]
[l = [2, 1], s = 1]
[l = [2, 1], s = 2]
[l = [2, 2], s = 1]
[l = [2, 2], s = 2]
[l = [2, 3], s = 1]
[l = [2, 3], s = 2]
[l = [3, 2], s = 1]
[l = [3, 2], s = 2]
[l = [3, 3], s = 1]
[l = [3, 3], s = 2]

0 quasi-live bindings

- Transition balancer_balance

24 live bindings

[l = [0, 2], c = 1]
[l = [0, 2], c = 2]
[l = [0, 2], c = 3]
[l = [0, 2], c = 4]
[l = [0, 2], c = 5]
[l = [0, 2], c = 6]
[l = [1, 3], c = 1]
[l = [1, 3], c = 2]

[l = [1, 3], c = 3]
[l = [1, 3], c = 4]
[l = [1, 3], c = 5]
[l = [1, 3], c = 6]
[l = [2, 0], c = 1]
[l = [2, 0], c = 2]
[l = [2, 0], c = 3]
[l = [2, 0], c = 4]
[l = [2, 0], c = 5]
[l = [2, 0], c = 6]
[l = [3, 1], c = 1]
[l = [3, 1], c = 2]
[l = [3, 1], c = 3]
[l = [3, 1], c = 4]
[l = [3, 1], c = 5]
[l = [3, 1], c = 6]

0 quasi-live bindings

- Transition balancer_no_balance

  9 live bindings

  [l = [0, 0]]
  [l = [0, 1]]
  [l = [1, 0]]
  [l = [1, 1]]
  [l = [1, 2]]
  [l = [2, 1]]
  [l = [2, 2]]
  [l = [2, 3]]
  [l = [3, 2]]

  0 quasi-live bindings