

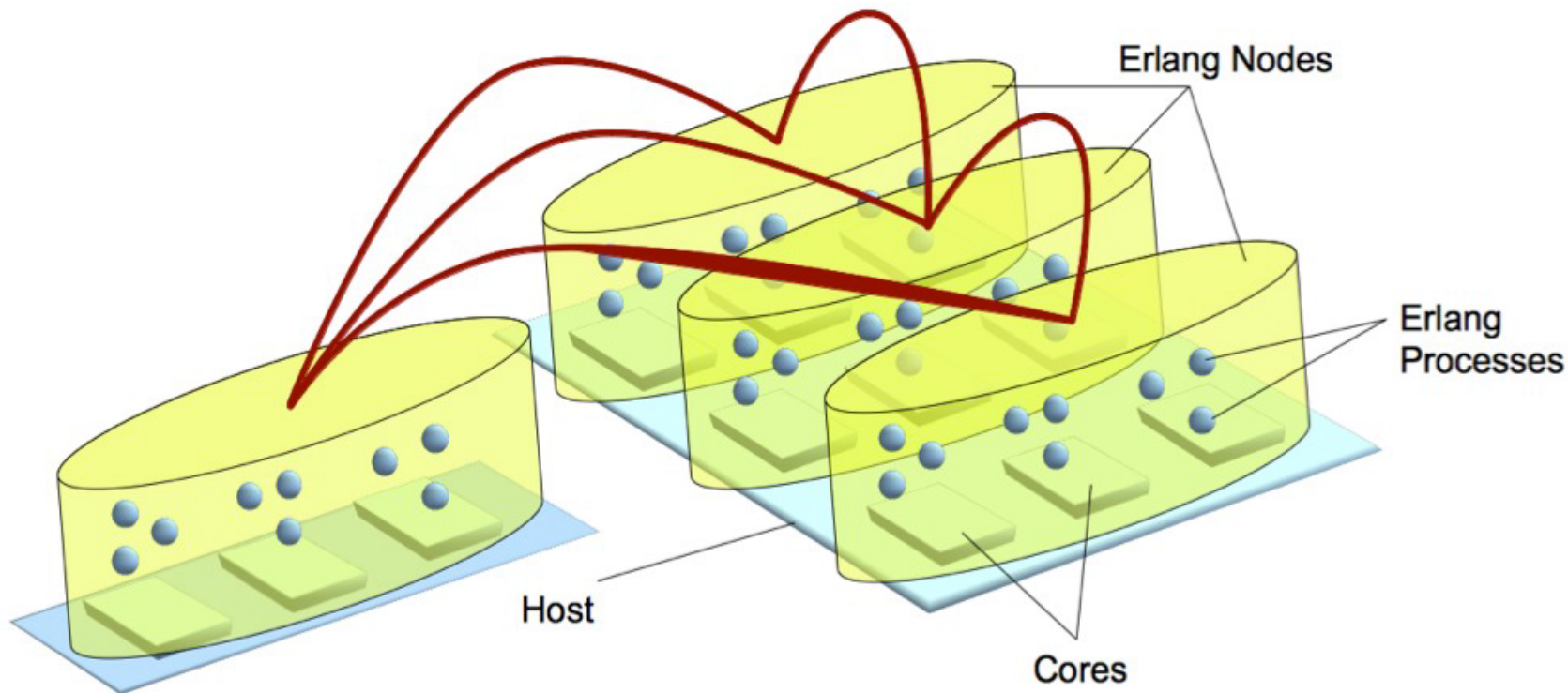
Profiling with Percept2

Huiqing Li and Simon Thompson
EUC 2013

Overview

- Erlang multicore ... RELEASE
- Percept and Percept2
- Case study with Wrangler
- Conclusions

Erlang multicore



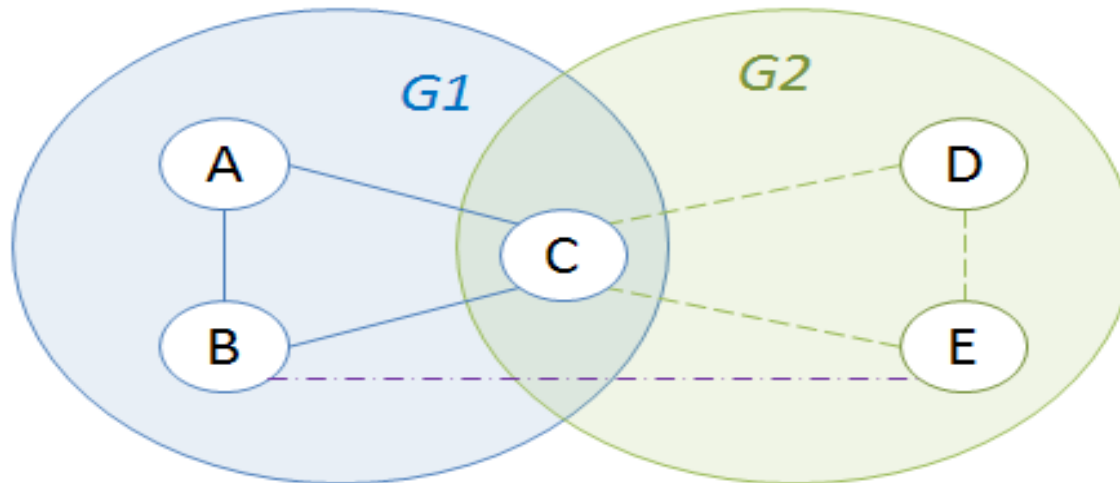
RELEASE

- EU FP7 STREP research project
- October 2011 – September 2013
- Partners:
 - Heriot Watt University (UK)
 - Uppsala University (Sweden)
 - University of Kent (UK)
 - ICCS (Greece)
 - Ericsson AB (Sweden)
 - Erlang Solutions (UK/Sweden)
 - EDF (France)



RELEASE

- Scalable distributed Erlang: system and tools.
- Groups and implicit placement.



Tools

How to use
these systems
effectively?



Existing tools

- Erlang tracing
- dbg/etop/ttb
- fprof/eprof/cprof
- Percept
- Dtrace
- ...

Percept

Percept

- **Percept: Erlang concurrency profiling tool.**
- In the Erlang/OTP distribution ...
- ... written by Björn-Egil Dahlberg.
- Monitors process runnability using
[erlang:trace/3](#), [erlang:system_profile/2](#).
- Offline tool ... ‘replay’ a computation.

Percept

- Histogram of active processes vs. time.
- ‘Drill down’ to process information via Pid.
- Start/end time, parent/child processes, time spent waiting for messages,
- View individual process runnability.

Percept

overview

processes

databases

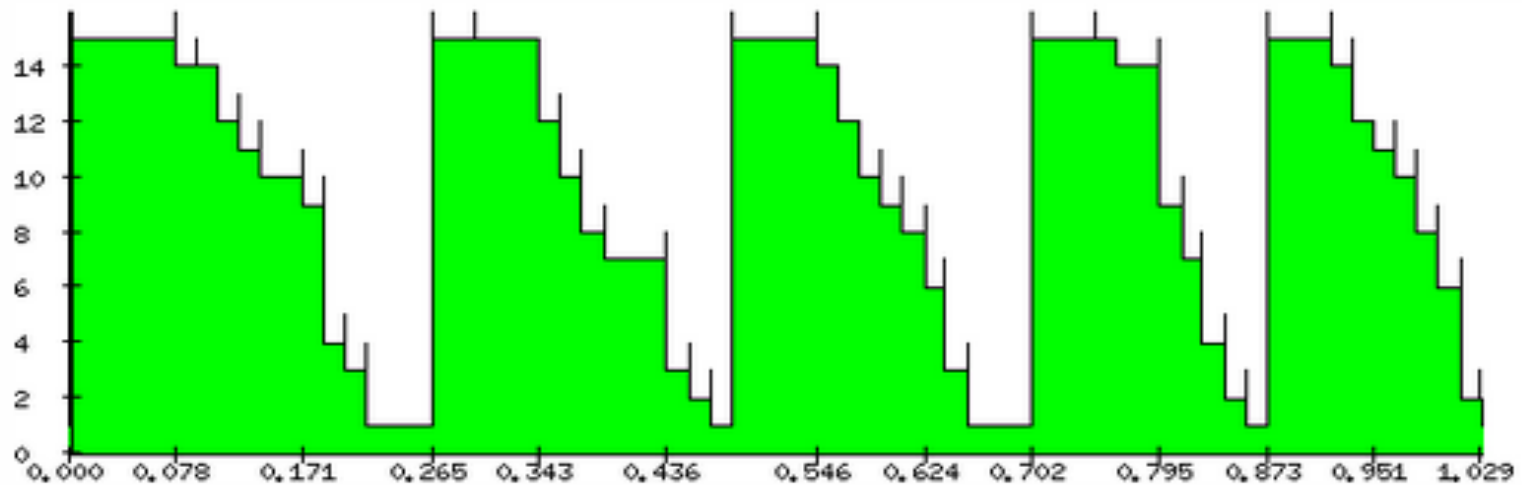
Profile time: 1.0451

Processes: 17

Ports: 0

Min. range: 0.0000

Max. range: 1.0450




















Min:

Ports & Processes ▼

Max:

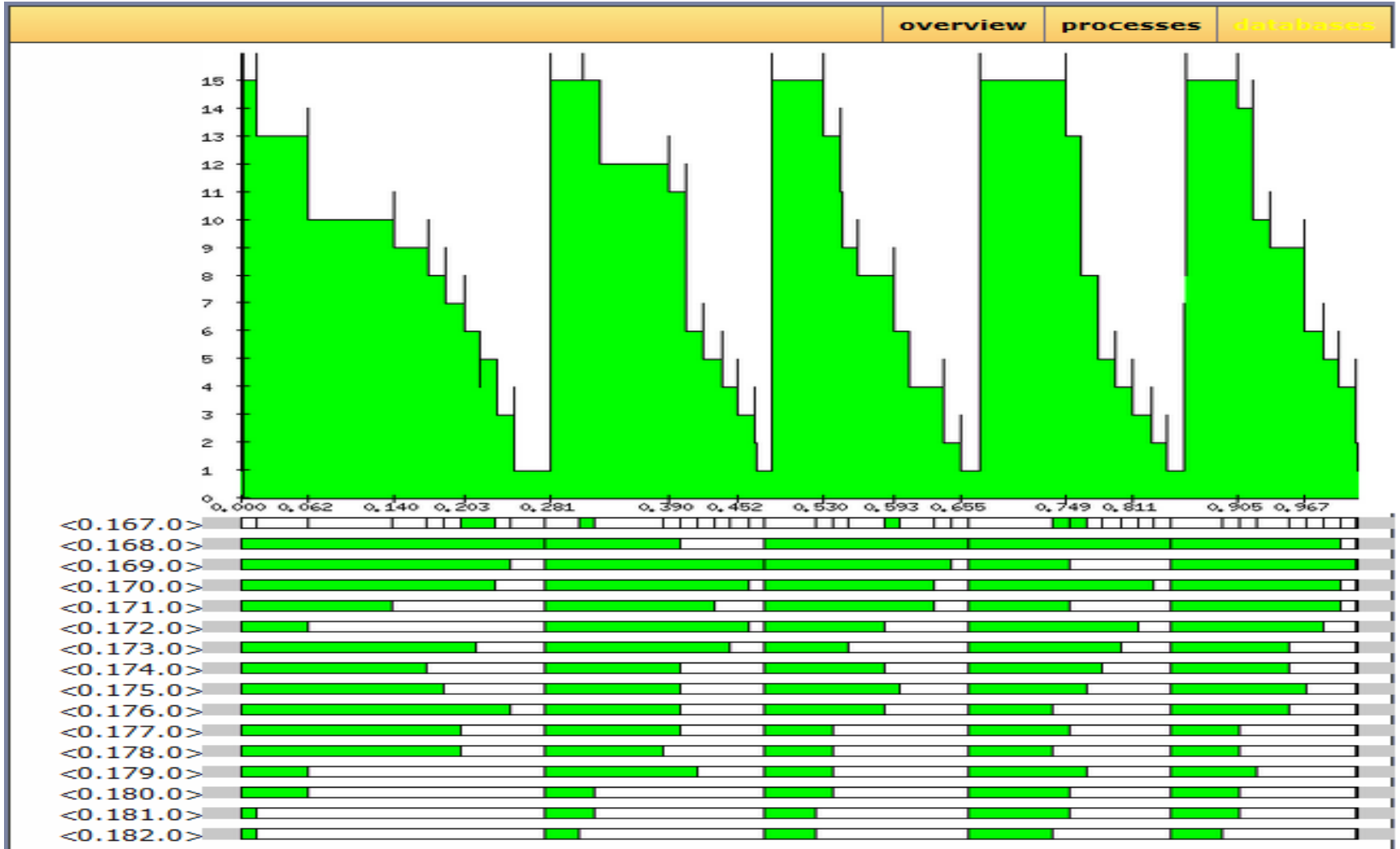
Code location

Percept

				overview	processes	databases
Select	Pid	Lifetime	Entrypoint	Name	Parent	
<input type="checkbox"/>	<0.37.0>		undefined	undefined	undefined	
<input checked="" type="checkbox"/>	<0.167.0>		sorter:main/4	undefined	<0.37.0>	
<input checked="" type="checkbox"/>	<0.168.0>		sorter:loop/0	undefined	<0.167.0>	
<input checked="" type="checkbox"/>	<0.169.0>		sorter:loop/0	undefined	<0.167.0>	
<input checked="" type="checkbox"/>	<0.170.0>		sorter:loop/0	undefined	<0.167.0>	
<input checked="" type="checkbox"/>	<0.171.0>		sorter:loop/0	undefined	<0.167.0>	
<input checked="" type="checkbox"/>	<0.172.0>		sorter:loop/0	undefined	<0.167.0>	
<input checked="" type="checkbox"/>	<0.173.0>		sorter:loop/0	undefined	<0.167.0>	
<input checked="" type="checkbox"/>	<0.174.0>		sorter:loop/0	undefined	<0.167.0>	
<input checked="" type="checkbox"/>	<0.175.0>		sorter:loop/0	undefined	<0.167.0>	
<input checked="" type="checkbox"/>	<0.176.0>		sorter:loop/0	undefined	<0.167.0>	
<input checked="" type="checkbox"/>	<0.177.0>		sorter:loop/0	undefined	<0.167.0>	
<input checked="" type="checkbox"/>	<0.178.0>		sorter:loop/0	undefined	<0.167.0>	
<input checked="" type="checkbox"/>	<0.179.0>		sorter:loop/0	undefined	<0.167.0>	
<input checked="" type="checkbox"/>	<0.180.0>		sorter:loop/0	undefined	<0.167.0>	
<input checked="" type="checkbox"/>	<0.181.0>		sorter:loop/0	undefined	<0.167.0>	
<input checked="" type="checkbox"/>	<0.182.0>		sorter:loop/0	undefined	<0.167.0>	

Select all

Percept



Percept2

Functionality enhancement: Usability and scalability:

- Scheduler information
 - Process communication
 - Process run queue migration
 - Runnable vs. running
 - Dynamic context-aware callgraph
 - Process/function accumulated runtime
 - Support for distribution
 - ...
- Scalable process tree
 - Cache history webpages
 - Parallel processing



Percept

Percept2

- How to use

- Profile a complete application run.

```
percept2:profile(FileSpec, Entry, Options).
```

```
-type profile_option()::procs | ports | schedulers  
    |running| message| migration  
    |all  
    |{callgraph, [module_name()]}.  
-type filespec()::file:filename()  
    |{file:filename(),wrap,Suffix::string(),  
    WrapSize::pos_integer(),  
    WrapCnt::pos_integer()}.
```

Percept2

- How to use

- Profile while application is running.

```
percept2:profile(FileSpec, Options).  
percept2:stop_profile().
```

- Profile a particular part of your application by instrumenting your code with `percept2:profile/2` and `percept2:stop_profile/0` commands.

Percept2

- How to analyze trace data

- analyze a single trace file.

```
percept2:analyze([FileName]).
```

- analyze a collection of trace files in parallel.

```
percept2:analyze(FileBaseName, Suffix,  
                StartIndex, EndIndex).
```

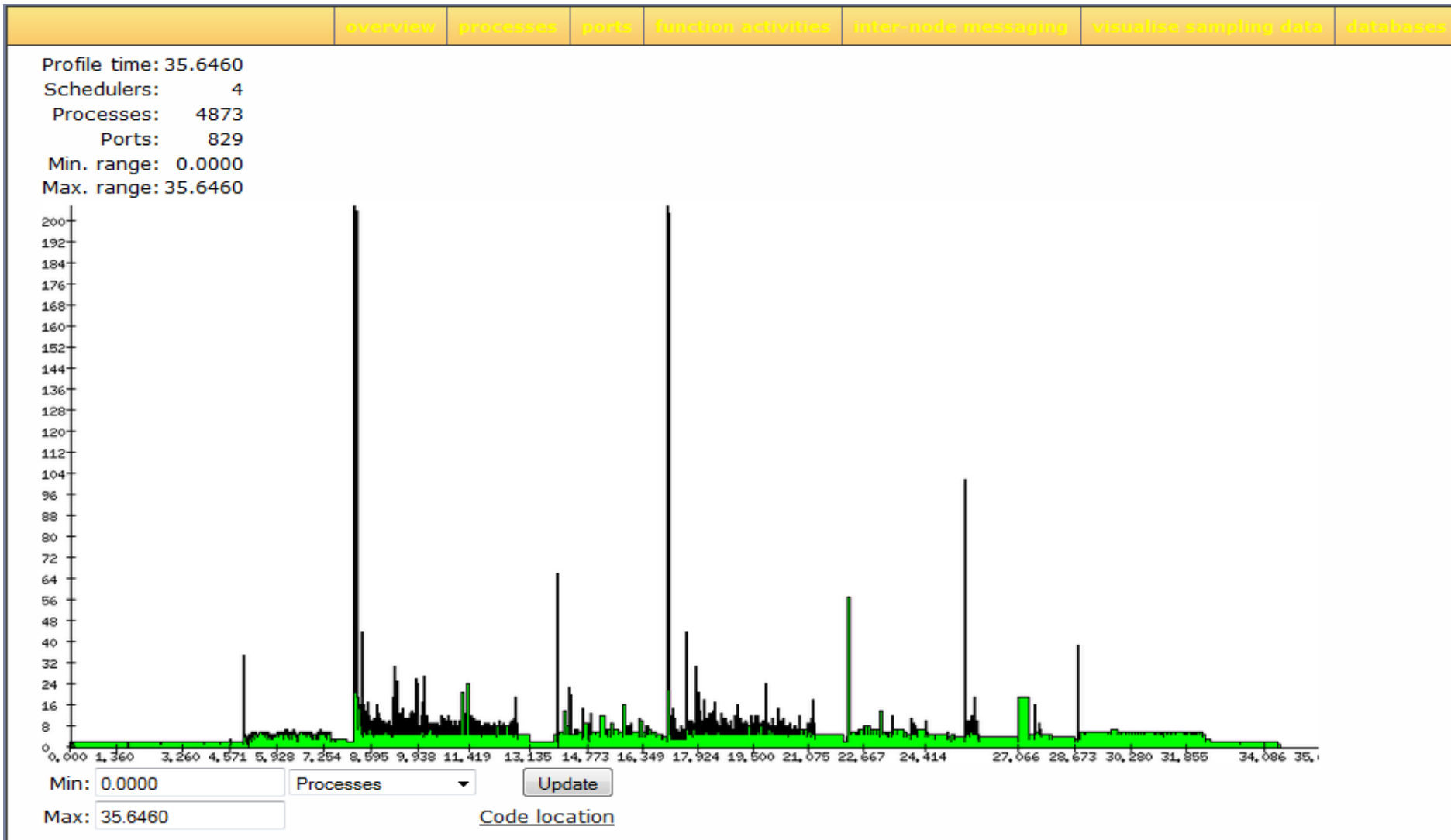
- How to visualize profiling data.

```
percept2:start_webserver(8888).
```

then go to `localhost:8888` in your web browser.

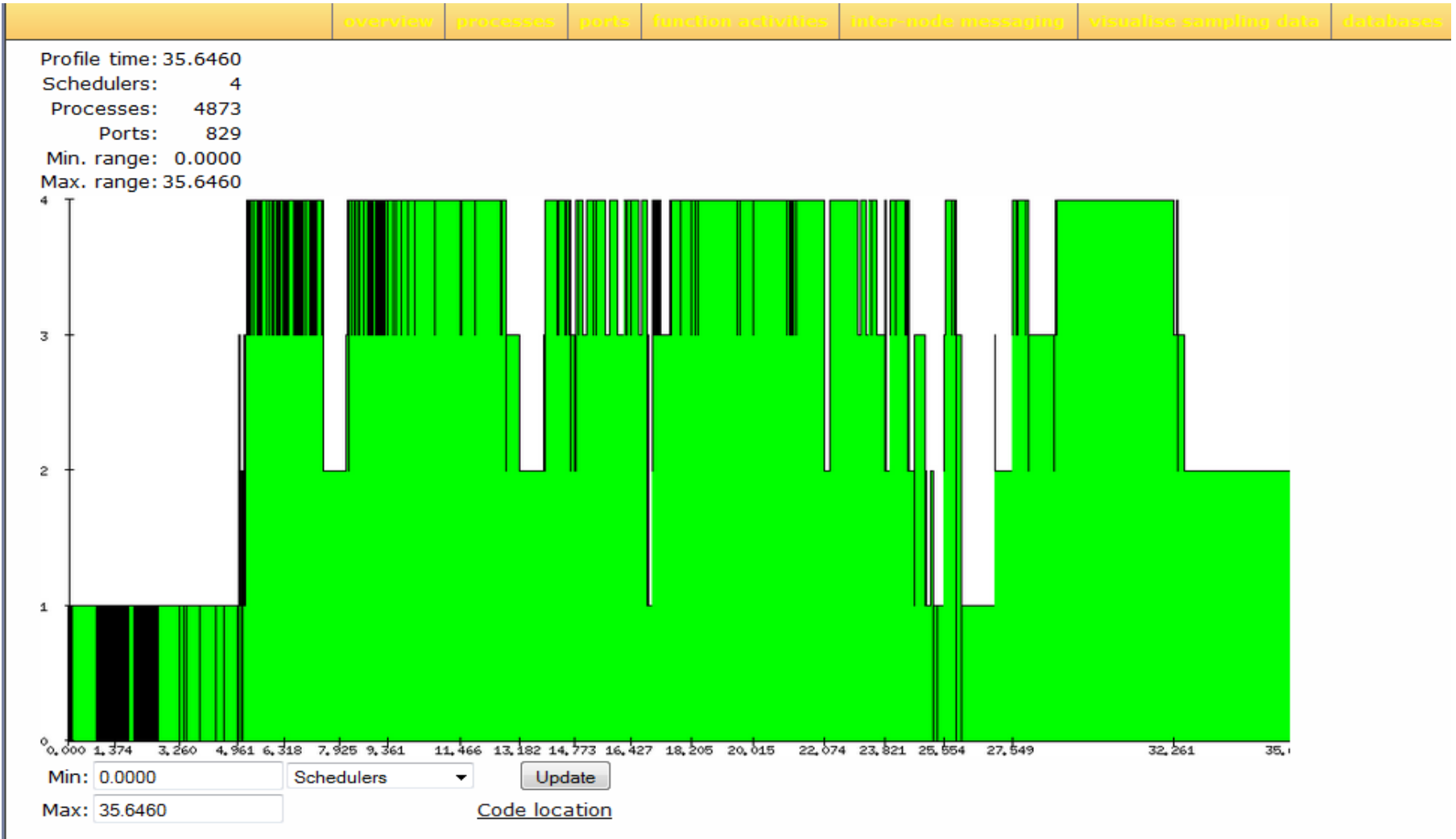
Percept2: process runnability

The number of runnable processes at any time.



Percept2: scheduler info

The number of schedulers active at any time.



Percept2: process info tree

Process info presented in expandable tree format.

						overview	processes	ports	function activities	inter-node messaging	visualise sample
Select	[+/-]	Pid	Lifetime	Name	Parent	#RQ_chgs	#msgs_received	#msgs_sent			
<input type="checkbox"/>	-	<0.22.0>	<div style="width: 100%; height: 10px; background-color: green;"></div>	undefined	undefined	0	{2,11}	{2,8}			
<input type="checkbox"/>	-	<0.20.0>	<div style="width: 100%; height: 10px; background-color: green;"></div>	undefined	undefined	0	{2,8}	{0,0}			
<input type="checkbox"/>	-	<0.25.0>	<div style="width: 100%; height: 10px; background-color: green;"></div>	undefined	undefined	19	{406,2825}	{406,90}			
<input type="checkbox"/>	-	<0.3.0>	<div style="width: 100%; height: 10px; background-color: green;"></div>	undefined	undefined	11	{1092,1094}	{350,3265}			
<input type="checkbox"/>	-	<0.24.0>	<div style="width: 100%; height: 10px; background-color: green;"></div>	undefined	undefined	0	{731,2187}	{364,4287}			
<input type="checkbox"/>	[H]	<0.38.0>	<div style="width: 100%; height: 10px; background-color: green;"></div>	undefined	undefined	0	{1,37}	{0,0}			

Select	[+/-]	Pid	Lifetime	Name	Parent	#RQ_chgs	#msgs_received	#msgs_sent	Entrypoint
<input type="checkbox"/>	[H]	<0.63.0>	<div style="width: 100%; height: 10px; background-color: green;"></div>	undefined	<0.38.0>	1	{1794,25462}	{301,136}	pid:'-run/0-fun-0-'/'0

Select	[+/-]	Pid	Lifetime	Name	Parent	#RQ_chgs	#msgs_received	#msgs_sent	Entrypoint	Callgraph
<input type="checkbox"/>	[H]	<0.64.0>	<div style="width: 100%; height: 10px; background-color: green;"></div>	undefined	<0.63.0>	0	{73,454717}	{70,471184}	dialyzer_analysis_callgraph:start/3	no callgraph/time

Select	[+/-]	Pid	Lifetime	Name	Parent	#RQ_chgs	#msgs_received	#msgs_sent	Entrypoint	Callgraph
<input type="checkbox"/>	+	0.65.0>	<div style="width: 100%; height: 10px; background-color: green;"></div>	undefined	<0.64.0>	1196	{4864,167}	{209,158804}	dialyzer_analysis_callgraph:analysis_start/2	no callgraph/time

Select all
 Include children procs
 Include omitted procs

 [Process Tree Graph](#)
 [Process Communication](#)

Percept2: process info tree

Process info presented in expandable tree format.

Select	[+/-]	Pid	Lifetime	Name	Parent	#RQ_chgs	#msgs_received	#msgs_sent	Entrypoint	Callgraph
<input type="checkbox"/>	-	<0.22.0>		undefined	undefined	0	{2,11}			
<input type="checkbox"/>	-	<0.20.0>		undefined	undefined	0	{2,8}			
<input type="checkbox"/>	-	<0.25.0>		undefined	undefined	19	{406,2825}			
<input type="checkbox"/>	-	<0.3.0>		undefined	undefined	11	{1092,1094}			
<input type="checkbox"/>	-	<0.24.0>		undefined	undefined	0	{731,2187}			
<input type="checkbox"/>	[H]	<0.38.0>		undefined	undefined	0	{1,37}			
<input type="checkbox"/>	[H]	<0.63.0>		undefined	<0.38.0>	1	{1794,25462}	{301,1		
<input type="checkbox"/>	[H]	<0.64.0>		undefined	<0.63.0>	0	{73,454717}	{70,471184}	dialyzer_analysis_cal	
<input type="checkbox"/>	[H]	<0.65.0>		undefined	<0.64.0>	1196	{4864,167}	{209,158804}	dialyzer_analysis_callgraph:analysis_start/2	
<input type="checkbox"/>	-	<0.66.0>		undefined	<0.65.0>	0	{1,17}	{0,0}	dialyzer_callgraph:race_data_server_loop/1	no callgraph/time
<input type="checkbox"/>	-	<0.*1*.0>		'4790 procs omitted'	<0.65.0>	10583	{11593,1385}	{20379,63}	dialyzer_worker:loop/2	no callgraph/time
<input type="checkbox"/>	-	<0.196.0>		undefined	<0.65.0>	1230	{5377,21}	{2688,12}	dialyzer_coordinator:regulator_loop/2	no callgraph/time
<input type="checkbox"/>	-	<0.*0*.0>		'7 procs omitted'	<0.65.0>	2181	{9461,21}	{4727,12}	dialyzer_coordinator:regulator_loop/2	no callgraph/time
<input type="checkbox"/>	-	<0.4873.0>		undefined	<0.65.0>	1	{1,12}	{2,352}	dialyzer_worker:loop/2	no callgraph/time




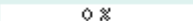

Select all Include children procs Include omitted procs

Compare

Process Tree Graph Process Communication

Percept2: process info

Information about a particular process

						overview	processes
Pid						<0.4981.0>	
Name						undefined	
Entrypoint						dialyzer_worker:loop/2	
Arguments							
	Timestamp	Profile	Time				
Timetable	Start {1370,944591,720014}		4.4930				
	Stop {1370,944591,766136}		4.5391				
Parent						<0.4978.0>	
Children						<0.5045.0>	
RQ_history						[1,2,1,4]	
{#msg_received, avg_msg_size}						{15,6344}	
{#msg_sent, avg_msg_size}						{3,1645}	
accumulated runtime (in secs)						0.0309	
Callgraph/time						no callgraph/time	
percentage of total waiting time	total	mean	stddev	#recv	module:function/arity		
	0.0144	0.0144	0	1	compile:do_compile/2		
	0.0002	0.0000	0.0000	8	prim_file:drv_get_response/1		
	0.0001	0.0000	0.0000	4	erlang:port_command/2		
	0.0000	0.0000	0	1	dialyzer_coordinator:get_next_label/2		
	0.0000	0.0000	0	1	dialyzer_worker:loop/2		

Percept2: process communication

Process info presented in expandable tree format.

Select	[+/-]	Pid	Lifetime	Name	Parent	#RQ_chgs	#msgs_received	#msgs_sent
<input type="checkbox"/>	-	<0.22.0>		undefined	undefined	0	{3,11}	{3,8}
<input type="checkbox"/>	-	<0.20.0>		undefined	undefined	0	{3,8}	{0,0}
<input type="checkbox"/>	-	<0.25.0>		undefined	undefined	0	{1,71}	{1,51}
<input type="checkbox"/>	-	<0.24.0>		undefined	undefined	0	{731,2187}	{364,4287}
<input type="checkbox"/>	[H]	<0.38.0>		undefined	undefined	1	{1785,25590}	{300,136}

Select	[+/-]	Pid	Lifetime	Name	Parent	#RQ_chgs	#msgs_received	#msgs_sent	Entrypoint
<input type="checkbox"/>	[H]	<0.4977.0>		undefined	<0.38.0>	0	{71,467524}	{70,471185}	dialyzer_analysis_callg
<input type="checkbox"/>	[H]	<0.4978.0>		undefined	<0.4977.0>	1175	{4856,167}	{209,158804}	dialyzer_analysis_callgraph:analysis_start/2_ca
<input type="checkbox"/>	-	<0.4979.0>		undefined	<0.4978.0>	0	{1,17}	{0,0}	dialyzer_callgraph:race_data_server_loop/1 callgraph/time
<input type="checkbox"/>	-	<0.*1*.0>		'4790 procs omitted'	<0.4978.0>	10679	{11647,1378}	{20379,63}	dialyzer_worker:loop/2 callgraph/time
<input type="checkbox"/>	-	<0.*0*.0>		'7 procs omitted'	<0.4978.0>	2044	{9461,21}	{4727,12}	dialyzer_coordinator:regulator_loop/2 callgraph/time
<input type="checkbox"/>	-	<0.7863.0>		undefined	<0.4978.0>	708	{3479,21}	{1739,12}	dialyzer_coordinator:regulator_loop/2 callgraph/time
<input type="checkbox"/>	-	<0.9786.0>		undefined	<0.4978.0>	1	{1,12}	{2,352}	dialyzer_worker:loop/2 callgraph/time

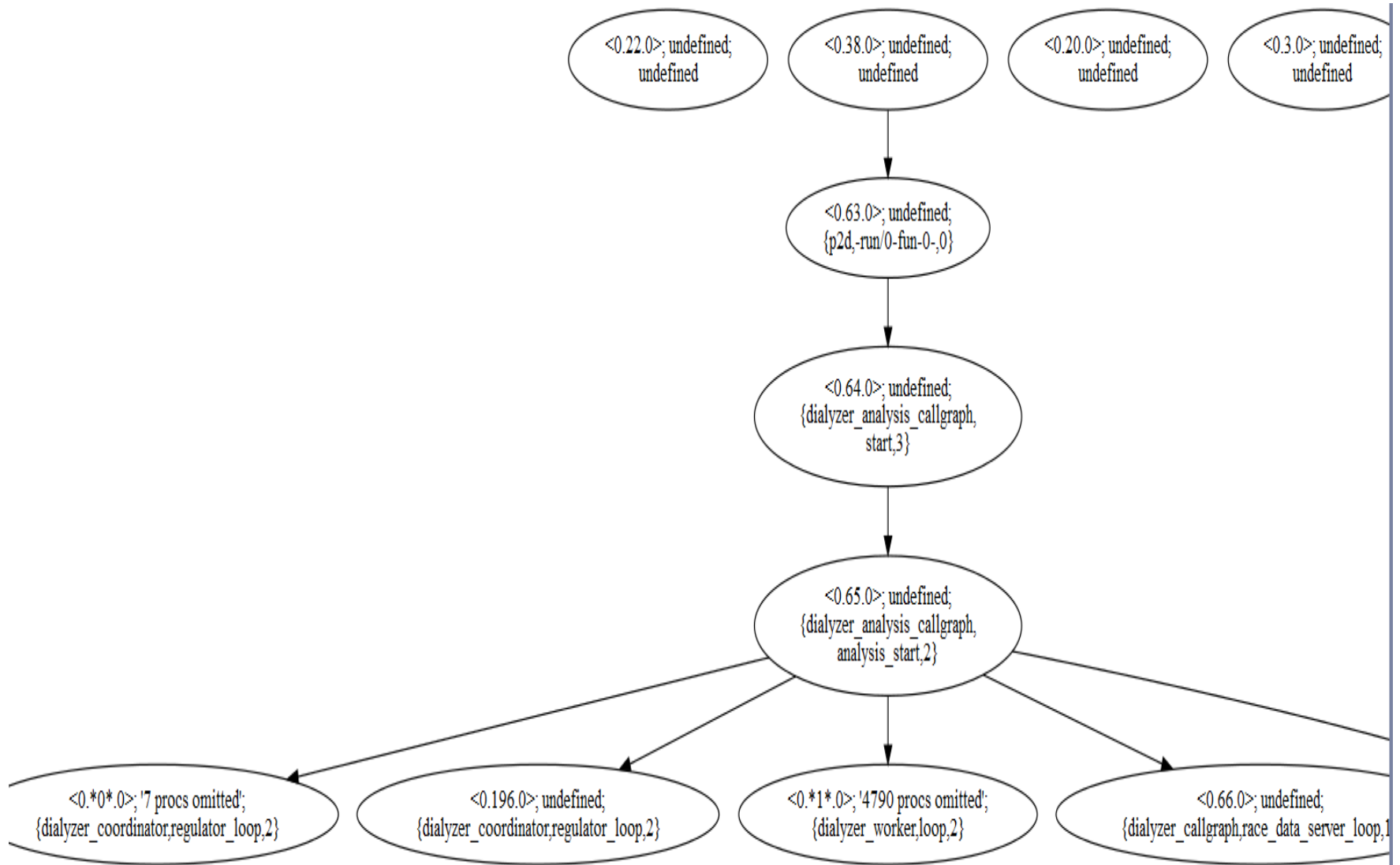
Select all Include children procs Include omitted procs

Compare

Process Tree Graph **Process Communication**

Percept2: process communication

Process tree in graph representation



Percept2: process communication

Process info presented in expandable tree format.

Select	[+/-]	Pid	Lifetime	Name	Parent	#RQ_chgs	#msgs_received	#msgs_sent
<input type="checkbox"/>	-	<0.22.0>		undefined	undefined	0	{3,11}	{3,8}
<input type="checkbox"/>	-	<0.20.0>		undefined	undefined	0	{3,8}	{0,0}
<input type="checkbox"/>	-	<0.25.0>		undefined	undefined	0	{1,71}	{1,51}
<input type="checkbox"/>	-	<0.24.0>		undefined	undefined	0	{731,2187}	{364,4287}
<input type="checkbox"/>	[H]	<0.38.0>		undefined	undefined	1	{1785,25590}	{300,136}

Select	[+/-]	Pid	Lifetime	Name	Parent	#RQ_chgs	#msgs_received	#msgs_sent	Entrypoint
<input type="checkbox"/>	[H]	<0.4977.0>		undefined	<0.38.0>	0	{71,467524}	{70,471185}	dialyzer_analysis_callg
<input type="checkbox"/>	[H]	<0.4978.0>		undefined	<0.4977.0>	1175	{4856,167}	{209,158804}	dialyzer_analysis_callgraph:analysis_start/2_ca
<input type="checkbox"/>	-	<0.4979.0>		undefined	<0.4978.0>	0	{1,17}	{0,0}	dialyzer_callgraph:race_data_server_loop/1 callgraph/time
<input type="checkbox"/>	-	<0.*1*.0>		'4790 procs omitted'	<0.4978.0>	10679	{11647,1378}	{20379,63}	dialyzer_worker:loop/2 callgraph/time
<input type="checkbox"/>	-	<0.*0*.0>		'7 procs omitted'	<0.4978.0>	2044	{9461,21}	{4727,12}	dialyzer_coordinator:regulator_loop/2 callgraph/time
<input type="checkbox"/>	-	<0.7863.0>		undefined	<0.4978.0>	708	{3479,21}	{1739,12}	dialyzer_coordinator:regulator_loop/2 callgraph/time
<input type="checkbox"/>	-	<0.9786.0>		undefined	<0.4978.0>	1	{1,12}	{2,352}	dialyzer_worker:loop/2 callgraph/time

Select all Include children procs Include omitted procs

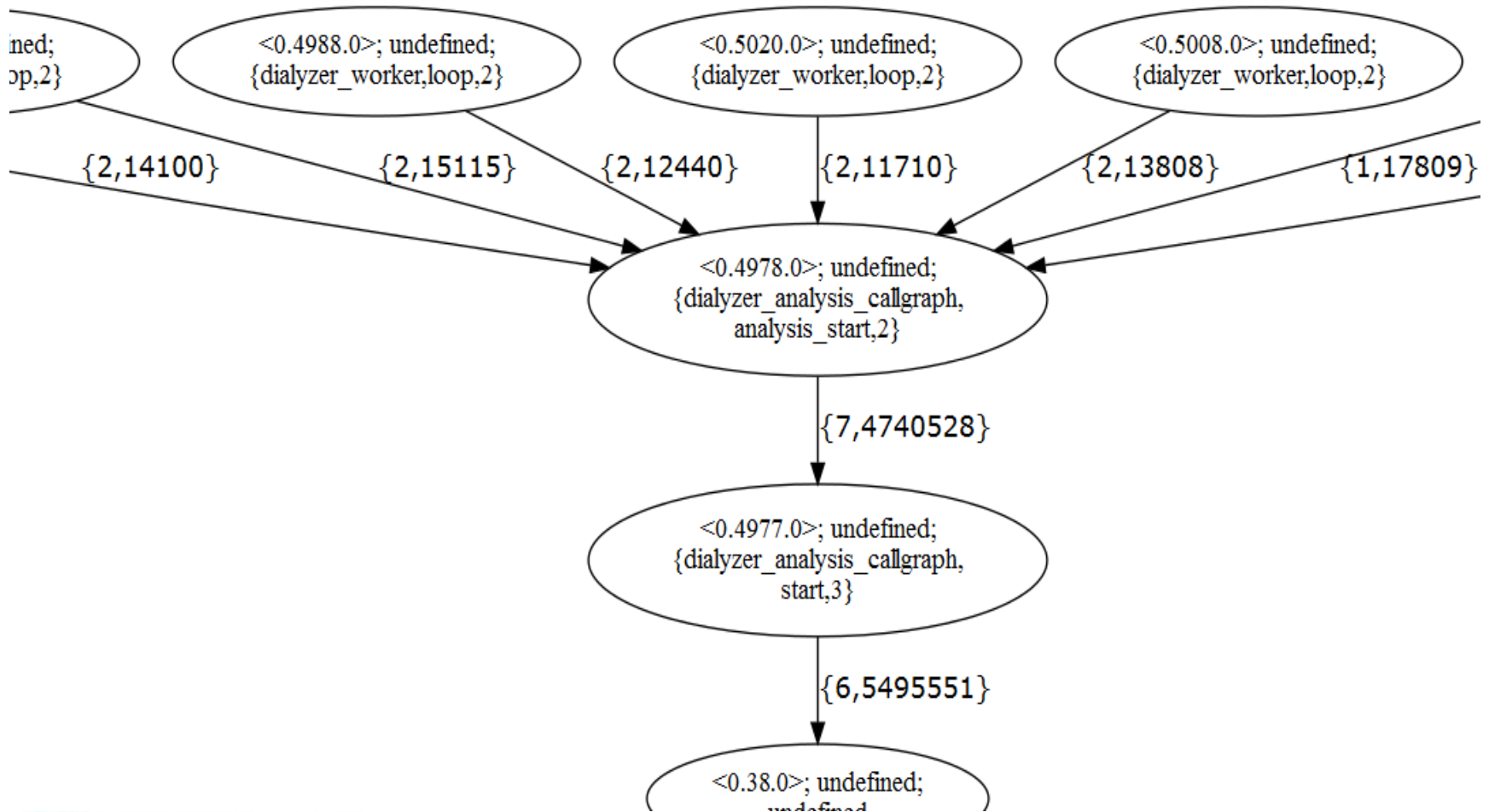
Compare

Process Tree Graph **Process Communication**

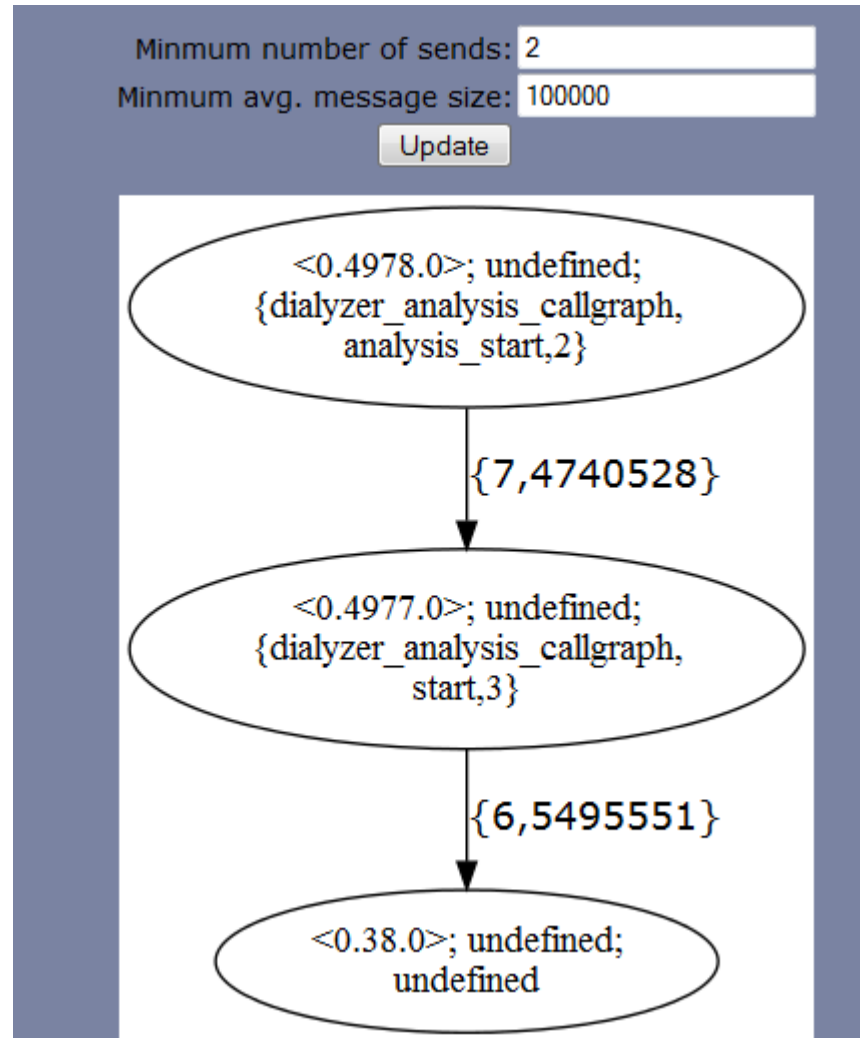
Percept2: process communication

Minmum number of sends:

Minmum avg. message size:



Percept2: process communication



Percept2: compare process runnability

Select	[+/-]	Pid	Lifetime	Name	Parent	#RQ_chgs	#msgs_received	#msgs_sent
<input checked="" type="checkbox"/>	-	<0.22.0>		undefined	undefined	0	{3,11}	{3,8}
<input checked="" type="checkbox"/>	-	<0.20.0>		undefined	undefined	0	{3,8}	{0,0}
<input checked="" type="checkbox"/>	-	<0.25.0>		undefined	undefined	0	{1,71}	{1,51}
<input checked="" type="checkbox"/>	-	<0.24.0>		undefined	undefined	0	{731,2187}	{364,4287}
<input checked="" type="checkbox"/>	[-]	<0.38.0>		undefined	undefined	1	{1785,25590}	{300,136}

Select	[+/-]	Pid	Lifetime	Name	Parent	#RQ_chgs	#msgs_received	#msgs_sent
<input checked="" type="checkbox"/>	[-]	<0.4977.0>		undefined	<0.38.0>	0	{71,467524}	{70,471185}

Select	[+/-]	Pid	Lifetime	Name	Parent	#RQ_chgs	#msgs_received	#msgs_sent	Entrypoint
<input checked="" type="checkbox"/>	[-]	<0.4978.0>		undefined	<0.4977.0>	1175	{4856,167}	{209,158804}	dialyzer_analysis_callgraph:analysis_start/2_cal

Select	[+/-]	Pid	Lifetime	Name	Parent	#RQ_chgs	#msgs_received	#msgs_sent	Entrypoint	Callgraph
<input checked="" type="checkbox"/>	-	<0.4979.0>		undefined	<0.4978.0>	0	{1,17}	{0,0}	dialyzer_callgraph:race_data_server_loop/1	no callgraph/time
<input checked="" type="checkbox"/>	-	<0.*1*.0>		'4790 procs omitted'	<0.4978.0>	10679	{11647,1378}	{20379,63}	dialyzer_worker:loop/2	no callgraph/time
<input checked="" type="checkbox"/>	-	<0.*0*.0>		'7 procs omitted'	<0.4978.0>	2044	{9461,21}	{4727,12}	dialyzer_coordinator:regulator_loop/2	no callgraph/time
<input checked="" type="checkbox"/>	-	<0.7863.0>		undefined	<0.4978.0>	708	{3479,21}	{1739,12}	dialyzer_coordinator:regulator_loop/2	no callgraph/time
<input checked="" type="checkbox"/>	-	<0.9786.0>		undefined	<0.4978.0>	1	{1,12}	{2,352}	dialyzer_worker:loop/2	no callgraph/time

Select all Include children procs Include omitted procs

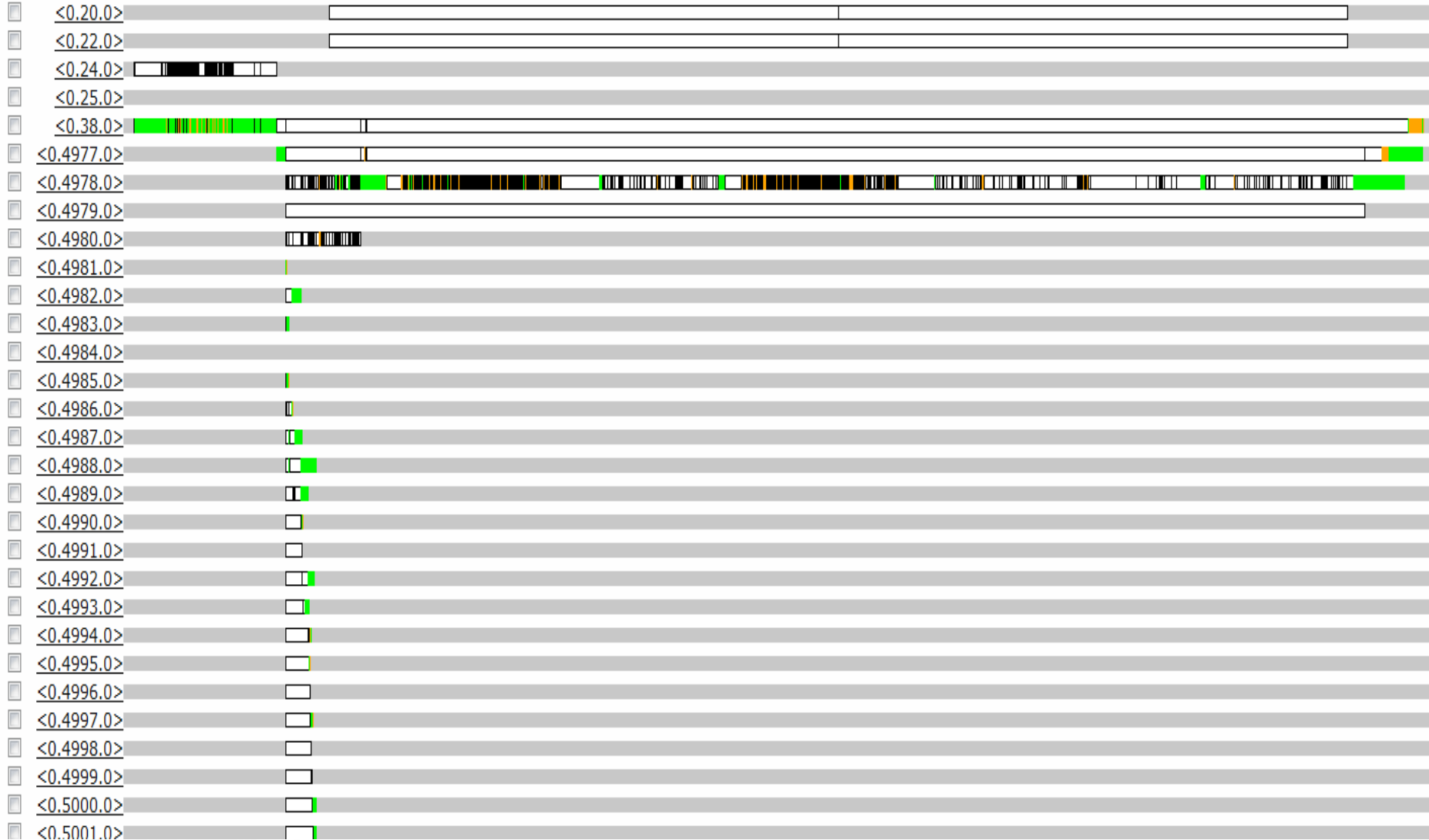
Compare

[Process Tree Graph](#)

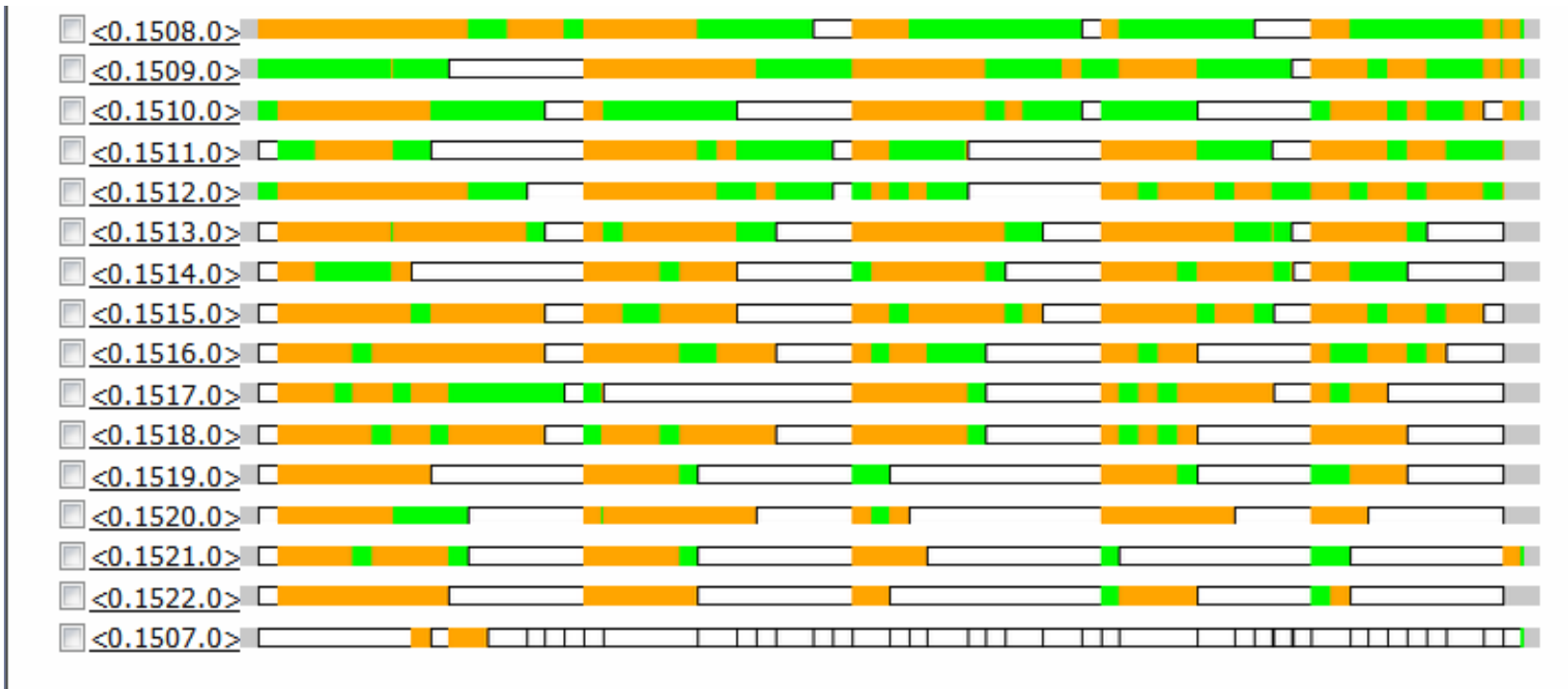
[Process Communication](#)

Percept2: compare process runnability

Compare Selected Processes



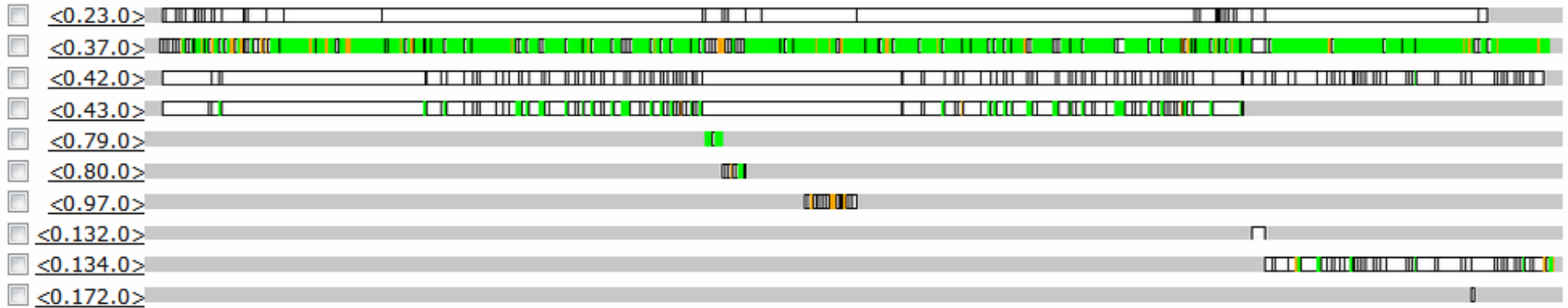
Percept2: compare process runnability



Green: running; Orange: runnable but not running; White: blocked.

Percept2: compare process runnability

Heavily loaded processes/load imbalance



Very short-lived processes



Percept2: function profiling

- Existing function profiling tools for Erlang:

Tool	Results	Size of result	Effects on program execution time	Records number of calls	Records Execution time	Records called by	Records garbage collection
fprof	per process to screen/file	large	significant slowdown	yes	total and own	yes	yes
eprof	per process/function to screen/file	medium	small slowdown	yes	only total	no	no
cover	per module to screen/file	small	moderate slowdown	yes, per line	no	no	no
cprof	per module to caller	small	small slowdown	yes	no	no	no

Percept2 →

Percept2: function profiling

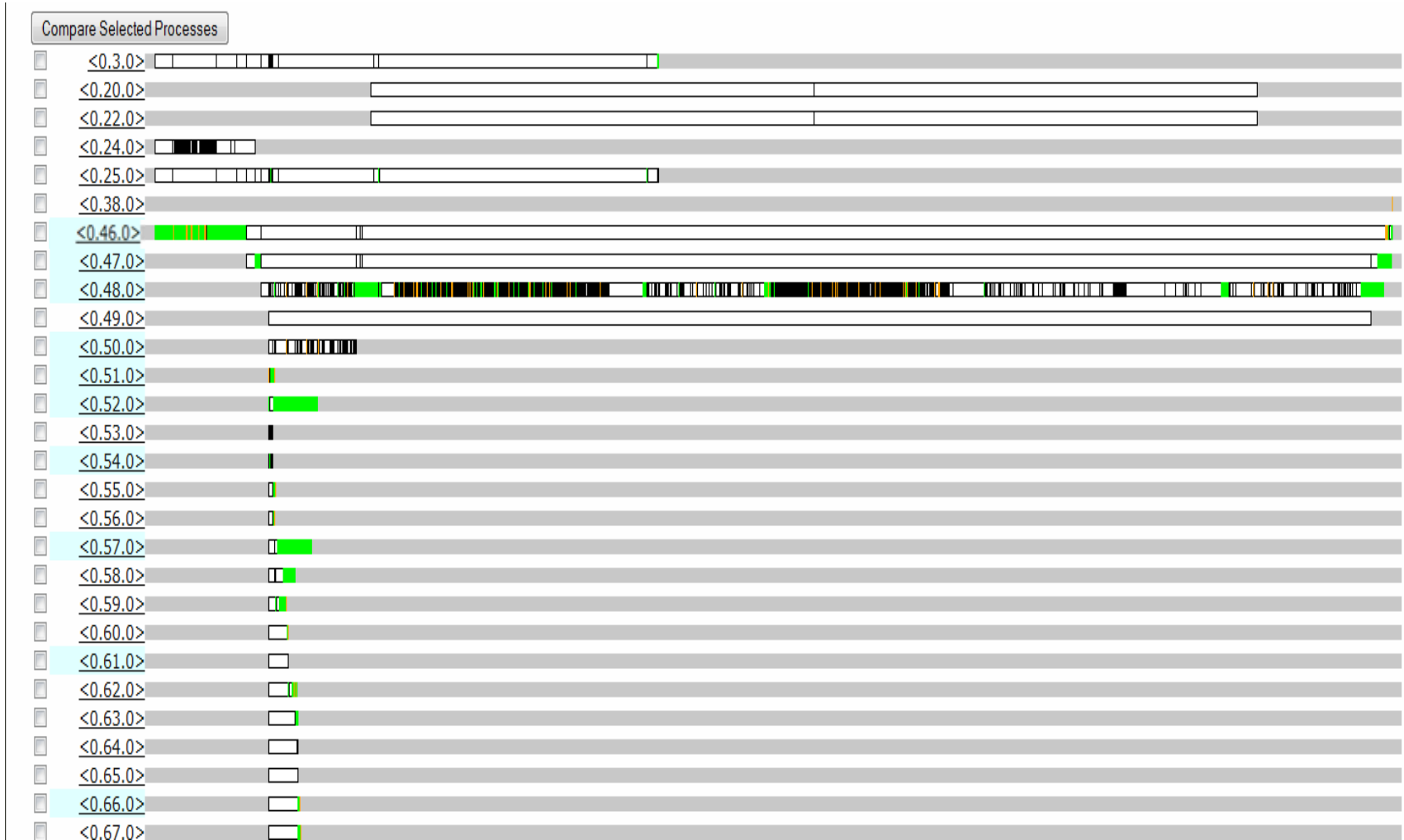
Tool	Results	Size of result	Effects on program execution time	Records number of calls	Records Execution time	Records called by	Records garbage collection
fprof	per process to screen/file	large	significant slowdown	yes	total and own	yes	yes

Percept2 per process to file *but can be selective* *depends on* yes only total yes yes

eprof	per process/function to screen/file	medium	small slowdown	yes	only total	no	no
cover	per module to screen/file	small	moderate slowdown	yes, per line	no	no	no
cprof	per module to caller	small	small slowdown	yes	no	no	no

... Percept2 only profiles functions defined in the modules specified by user.

Percept2: function profiling



A process' pid is highlighted if it has a callgraph generated.

Percept2: function profiling

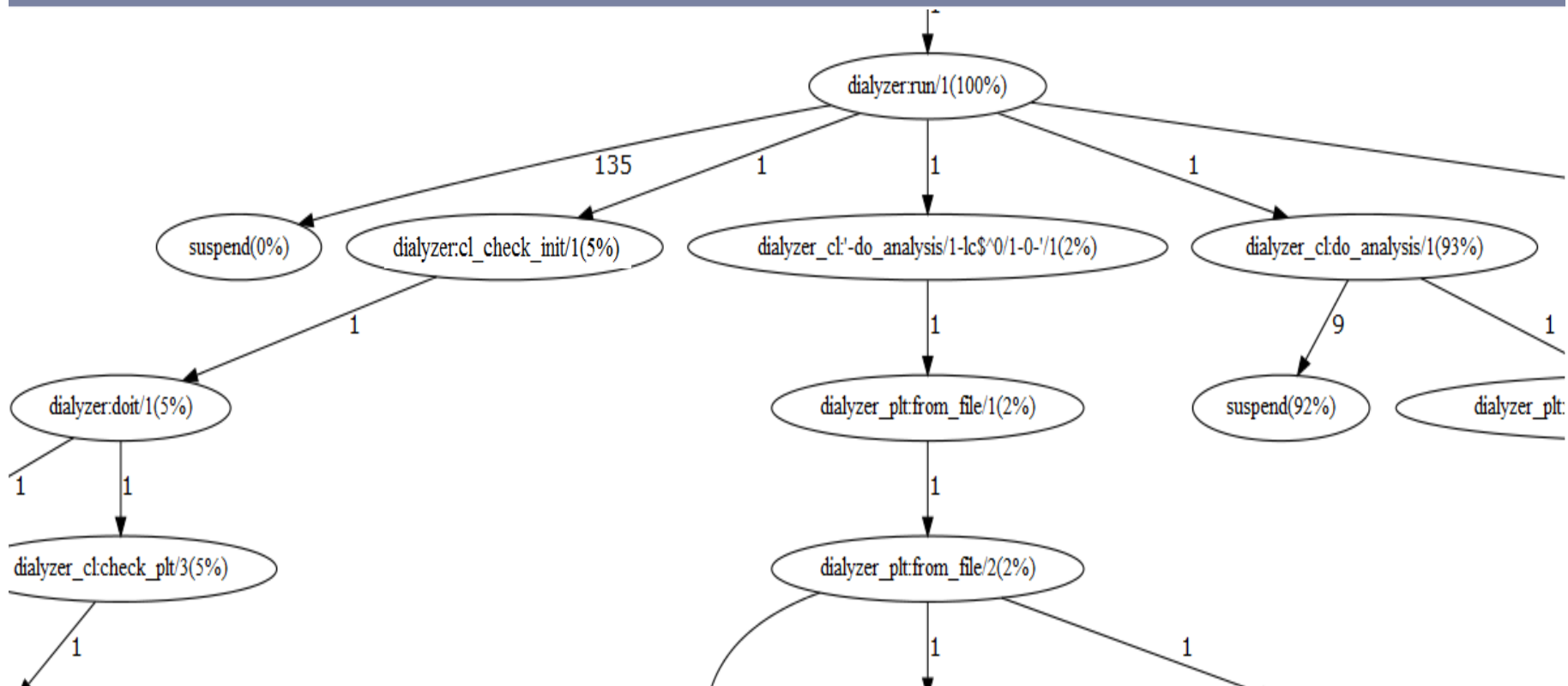
Pid	<0.46.0>	
Name	undefined	
Entrypoint	p2d:'-run/0-fun-0-' /0	
Arguments		
Timetable	Timestamp	Profile Time
	Start{1370,980952,698000}	0.2030
	Stop{1370,980994,600004}	42.1050
Parent	<0.38.0>	
Children	<0.47.0>	
RQ_history	[]	
{#msg_received, avg_msg_size}	{0,0}	
{#msg_sent, avg_msg_size}	{0,0}	
accumulated runtime (in secs)	2.7635	
Callgraph/time	show call graph/time	

percentage of total waiting time	total	mean	stddev	#recv	module:function/arity
100%	38.6250	6.4375	12.6777	6	dialyzer_cl:cl_loop/2
0%	0.0522	0.0001	0.0012	463	gen:do_call/4
0%	0.0241	0.0027	0.0051	9	code_server:call/2
0%	0.0023	0.0000	0.0000	1970	prim_file:drv_get_response/1

Percept2: function profiling

<0.46.0>

Minimum number of callcounts:
Minimum time percentage:



Percept2: function profiling

Accumulated time during which a function within this process is in a running state.

Pid	<0.46.0>	
Entrypoint	p2d:'-run/0-fun-0-'/0	
M:F/A	<u>dialyzer:cl_check_init/1</u>	
Call count	1	
Accumulated time (in secs)	2.0614	
Callers	module:function/arity	call count
	<u>dialyzer:run/1</u>	1
Called	module:function/arity	call count
	<u>dialyzer:doit/1</u>	1

Percept2: distribution

overview processes ports function activities inter-node messaging

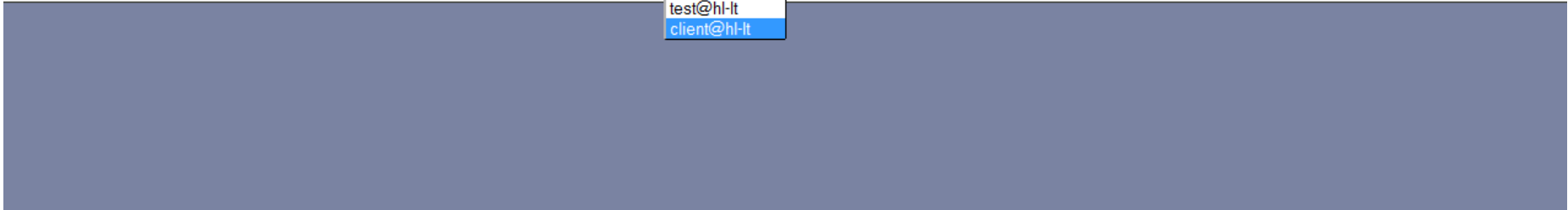
From node:

- server@hl-It
- server@hl-It
- test@hl-It
- client@hl-It

To node:

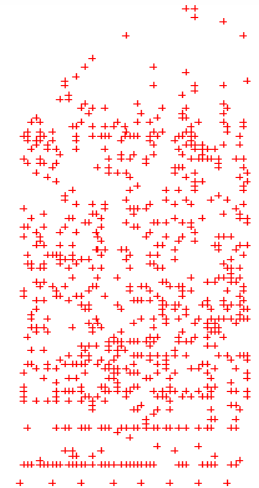
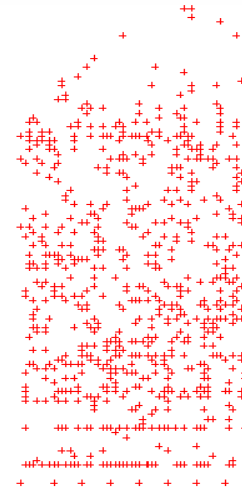
server@hl-It

Generate Graph



overview processes ports function activities inter-node messaging summary report databases

135
130
125
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0



3,078 3,246 3,418 3,590 3,761 3,933

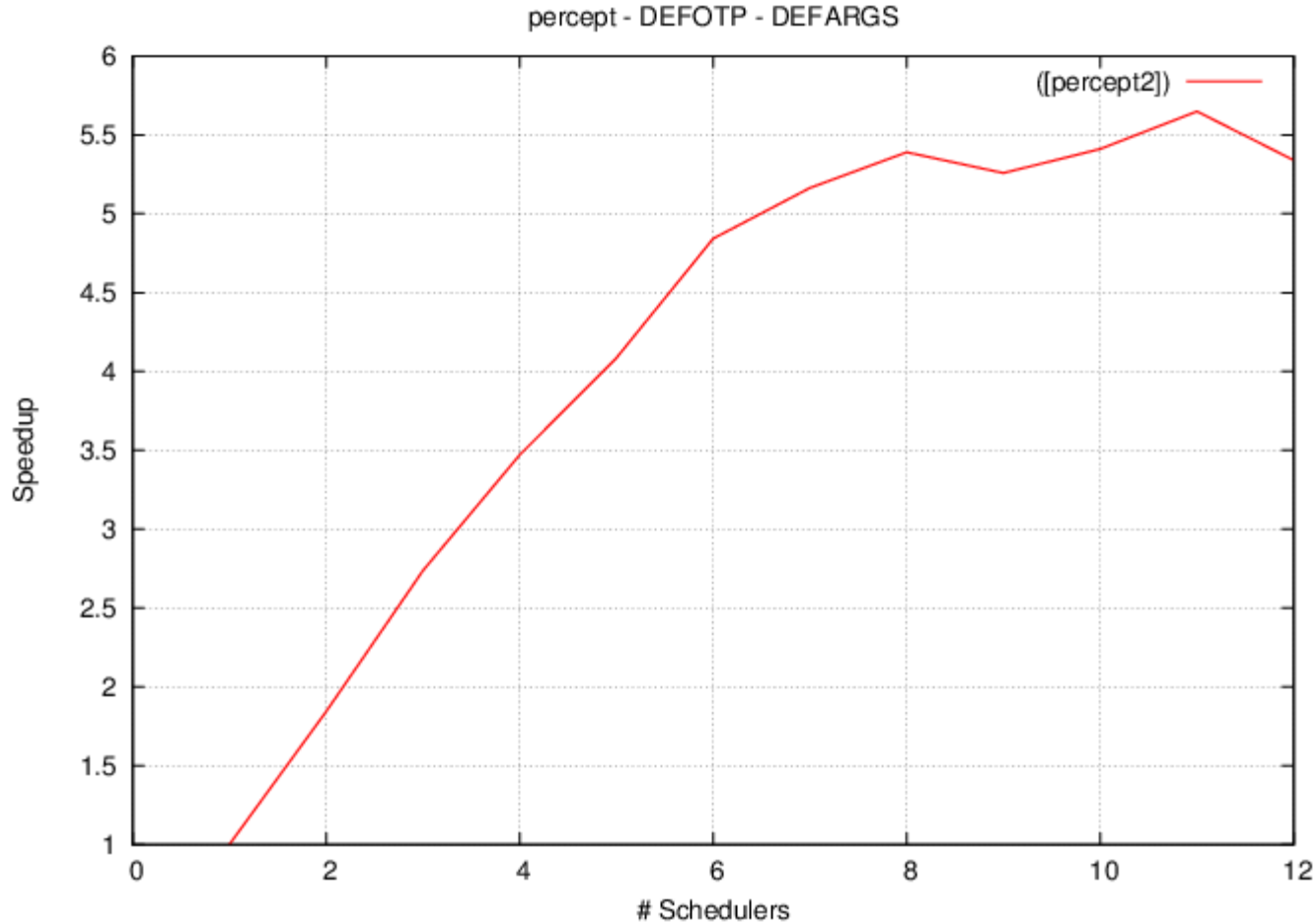
5,758 5,930 6,101 6,273 6,444 6,616

Min: 0.0000 Max: 6.6465 Update

Percept2: scalability

- Parallelise Percept2 itself.
- Multiple log files ...
- ... that can be processed in parallel ...
- ... and integrated into a single result.

Percept2: scalability



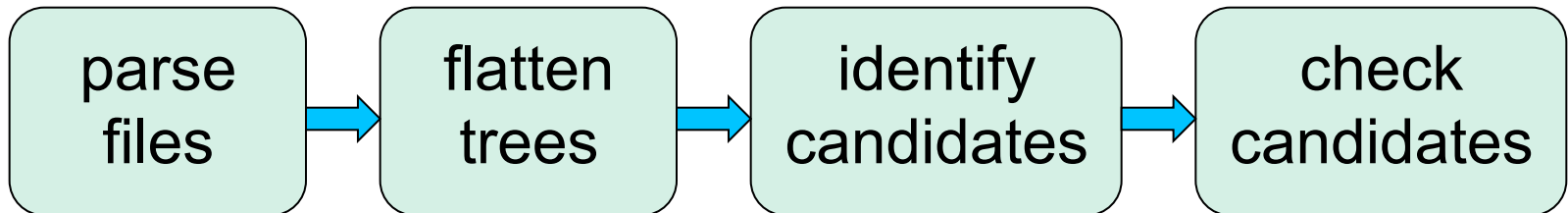
Scalability of Percept2 when analysing 5 trace files (total size: 1.36G, 11,008,609 traces messages) in parallel.

Percept2

More features are being added ...

Percept2: case study

Clone detection in Wrangler



Percept2: case study

overview

processes

ports

function activities

inter-node messaging

visualise sampling data

databases

Profile time: 6.9260

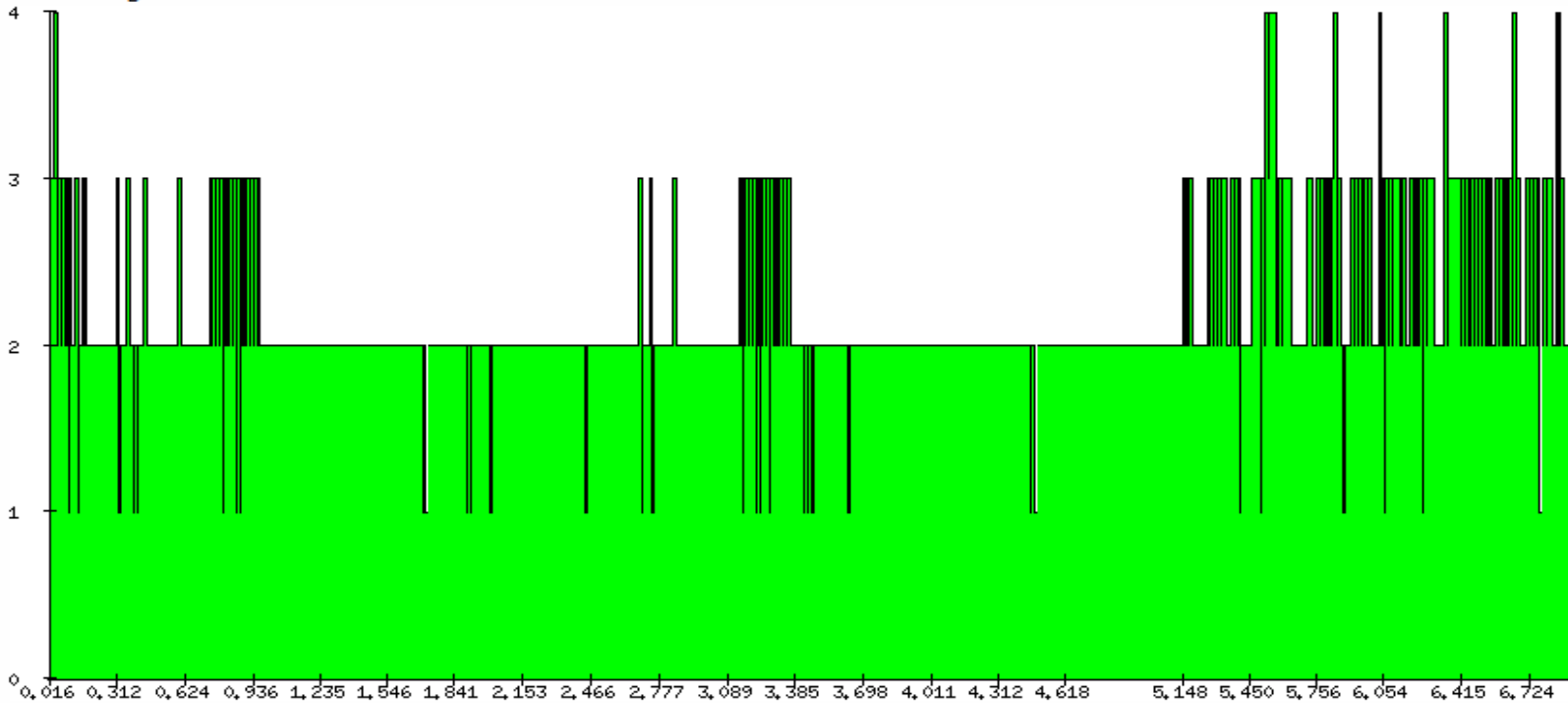
Schedulers: 4

Processes: 158

Ports: 115

Min. range: 0.0000

Max. range: 6.9260



Min: 0.0000

Processes

Update

Max: 6.9260

[Code location](#)

Percept2: case study

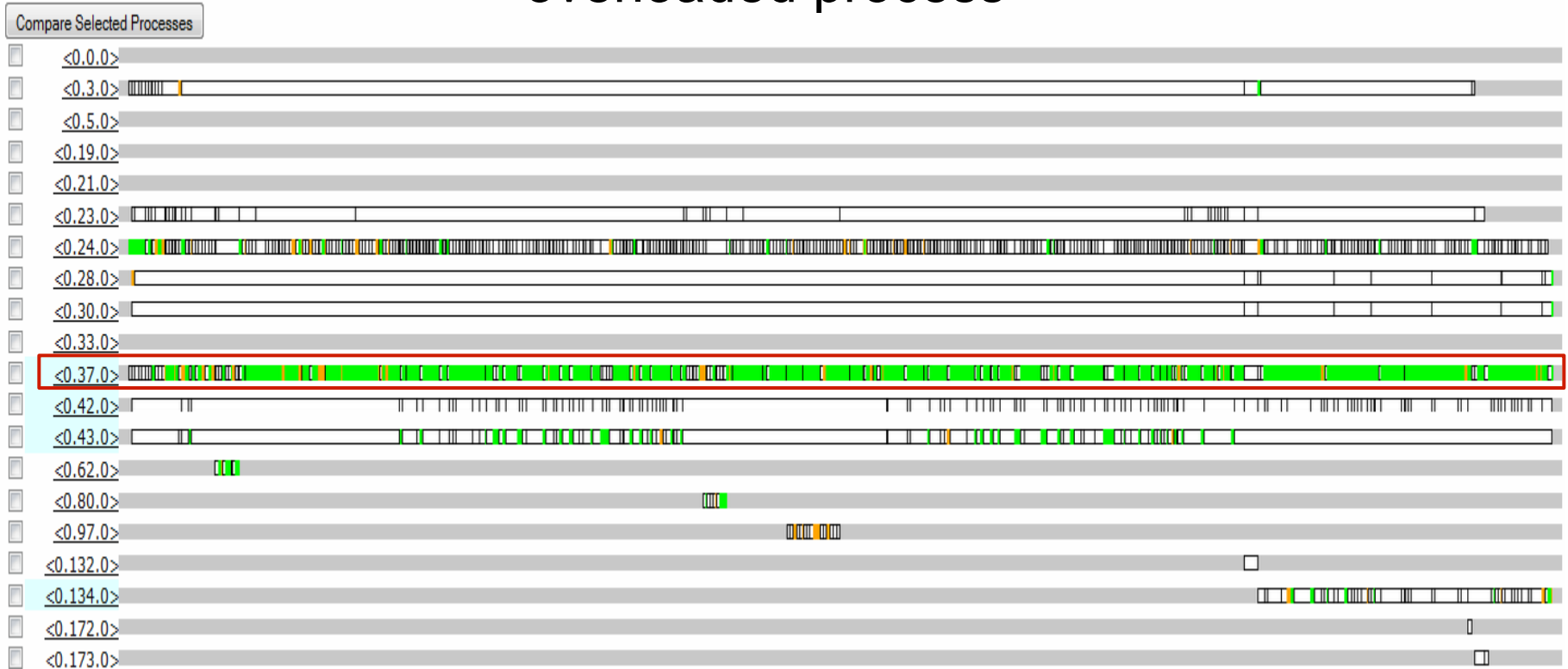
										overview	processes	ports
Select[+/-]	Pid	Lifetime	Name	Parent	#RQ_chgs	#msgs_received	#msgs_sent	Entrypoint	Callgraph			
<input checked="" type="checkbox"/> -	<0.21.0>		undefined	undefined	0	{1,11}	{1,8}	undefined	no callgraph/time			
<input checked="" type="checkbox"/> +	<0.33.0>		undefined	undefined	0	{5,101}	{5,164}	undefined	no callgraph/time			
<input checked="" type="checkbox"/> +	<0.37.0>		undefined	undefined	2	{20053,1678}	{20150,151}	undefined	show call graph/time			
<input checked="" type="checkbox"/> -	<0.19.0>		undefined	undefined	0	{1,8}	{0,0}	undefined	no callgraph/time			
<input checked="" type="checkbox"/> -	<0.0.0>		undefined	undefined	0	{3,56}	{3,18}	undefined	no callgraph/time			
<input checked="" type="checkbox"/> -	<0.24.0>		undefined	undefined	2	{16036,167}	{16036,55}	undefined	no callgraph/time			
<input checked="" type="checkbox"/> -	<0.28.0>		undefined	undefined	1	{11,91}	{11,86}	undefined	no callgraph/time			
<input checked="" type="checkbox"/> -	<0.3.0>		undefined	undefined	0	{609,2552}	{183,8337}	undefined	no callgraph/time			
<input checked="" type="checkbox"/> +	<0.23.0>		undefined	undefined	0	{464,1227}	{141,3867}	undefined	no callgraph/time			
<input checked="" type="checkbox"/> -	<0.30.0>		undefined	undefined	1	{11,143}	{22,66}	undefined	no callgraph/time			
<input checked="" type="checkbox"/> -	<0.5.0>		undefined	undefined	0	{2,315}	{0,0}	undefined	no callgraph/time			

Select all
 Include children procs
 Include omitted procs

[Process Tree Graph](#)
[Process Communication](#)

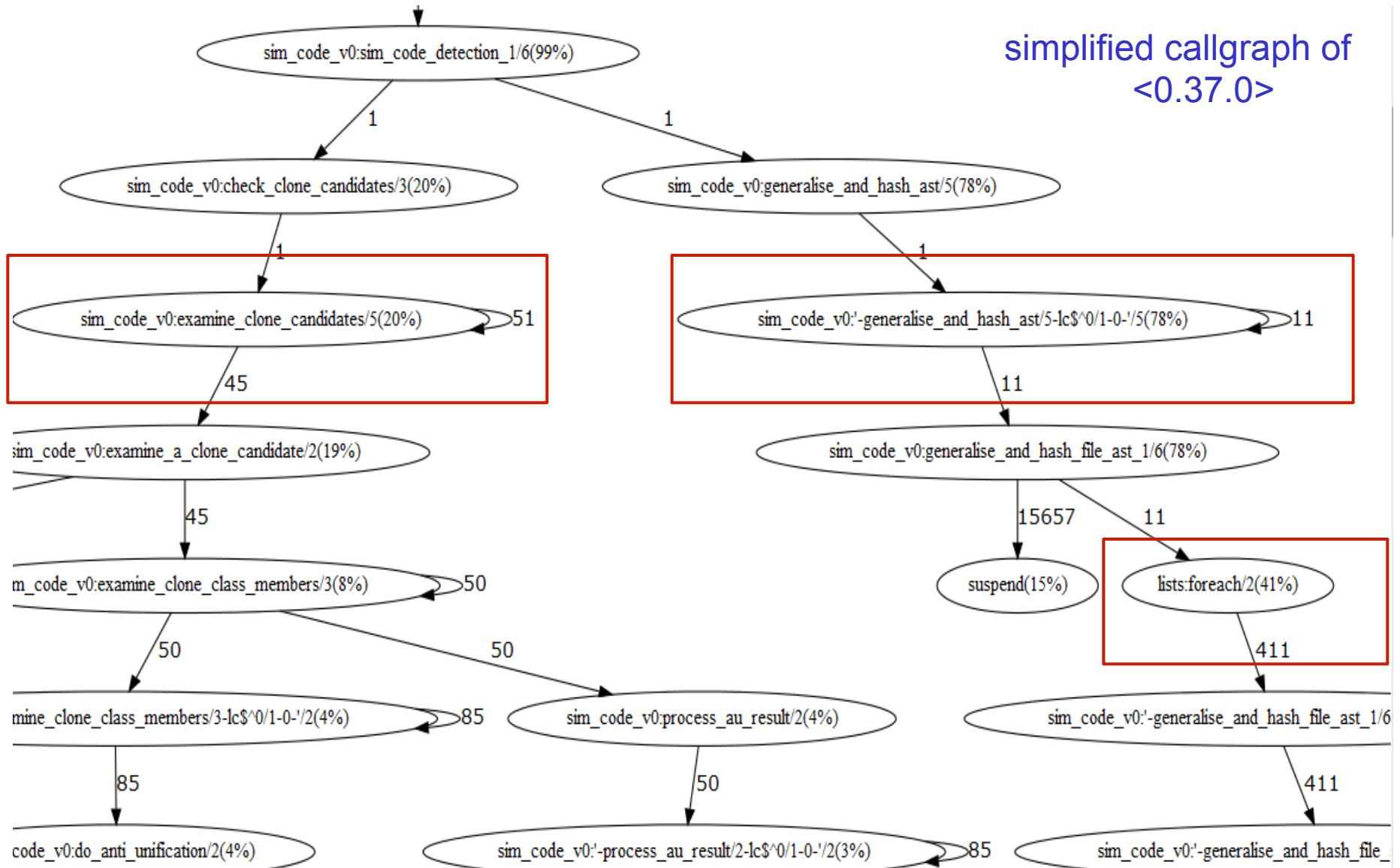
Percept2: case study

overloaded process



Percept2: case study

simplified callgraph of
<0.37.0>



Percept2: case study

Refactoring #1: List comprehension to parallel map

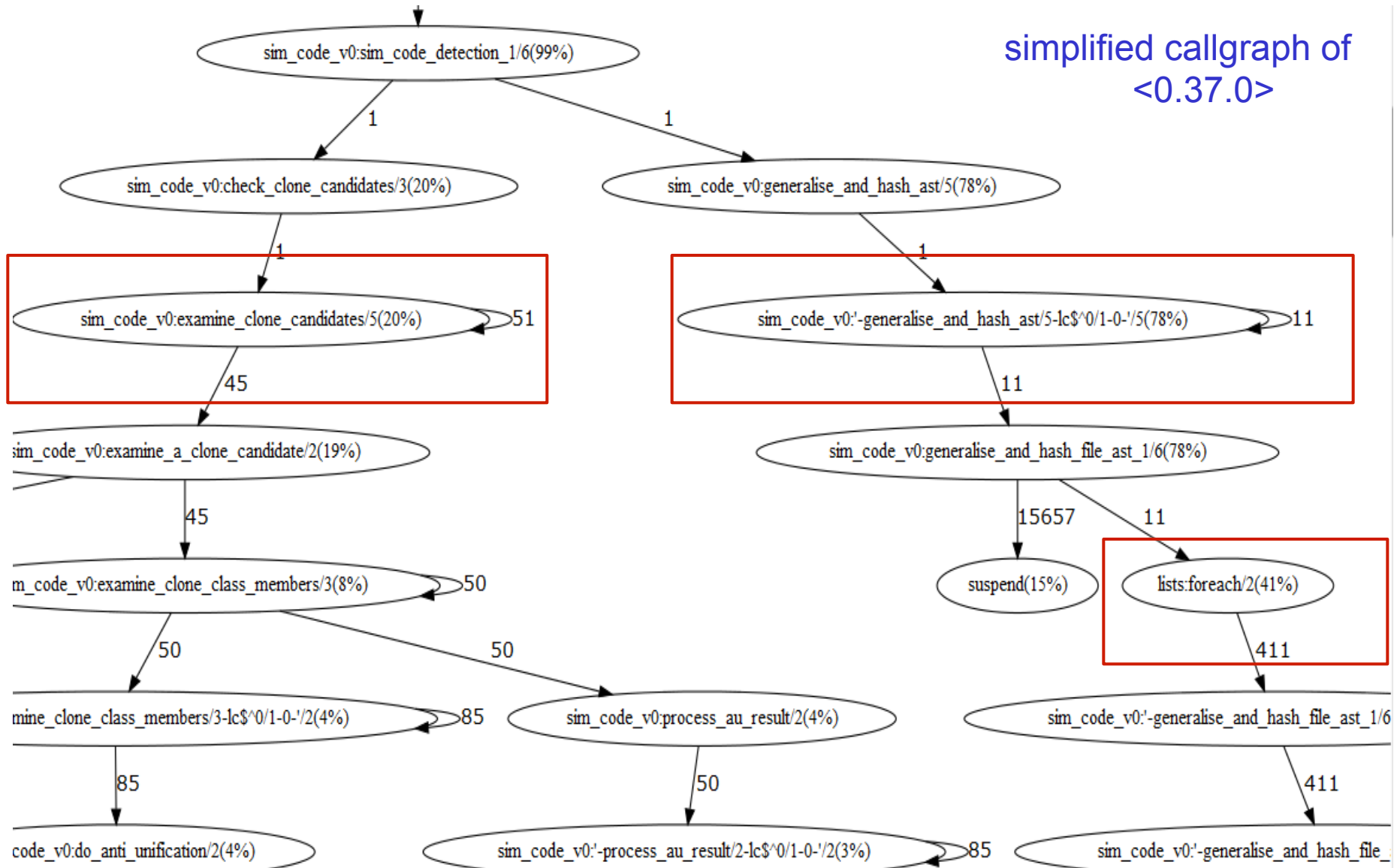
```
[generalise_and_hash_file_ast_1(  
  File, Threshold, ASTPid, true, SearchPaths, TabWidth)  
  || File <- Files]
```



```
para_lib:pmap(  
  fun(File) -> generalise_and_hash_file_ast_1(  
    File, Threshold, ASTPid, true, SearchPaths, TabWidth)  
  end, Files)
```

Percept2: case study

simplified callgraph of
<0.37.0>



Percept2: case study

Refac #2: sequential 'foreach' to parallel 'foreach'

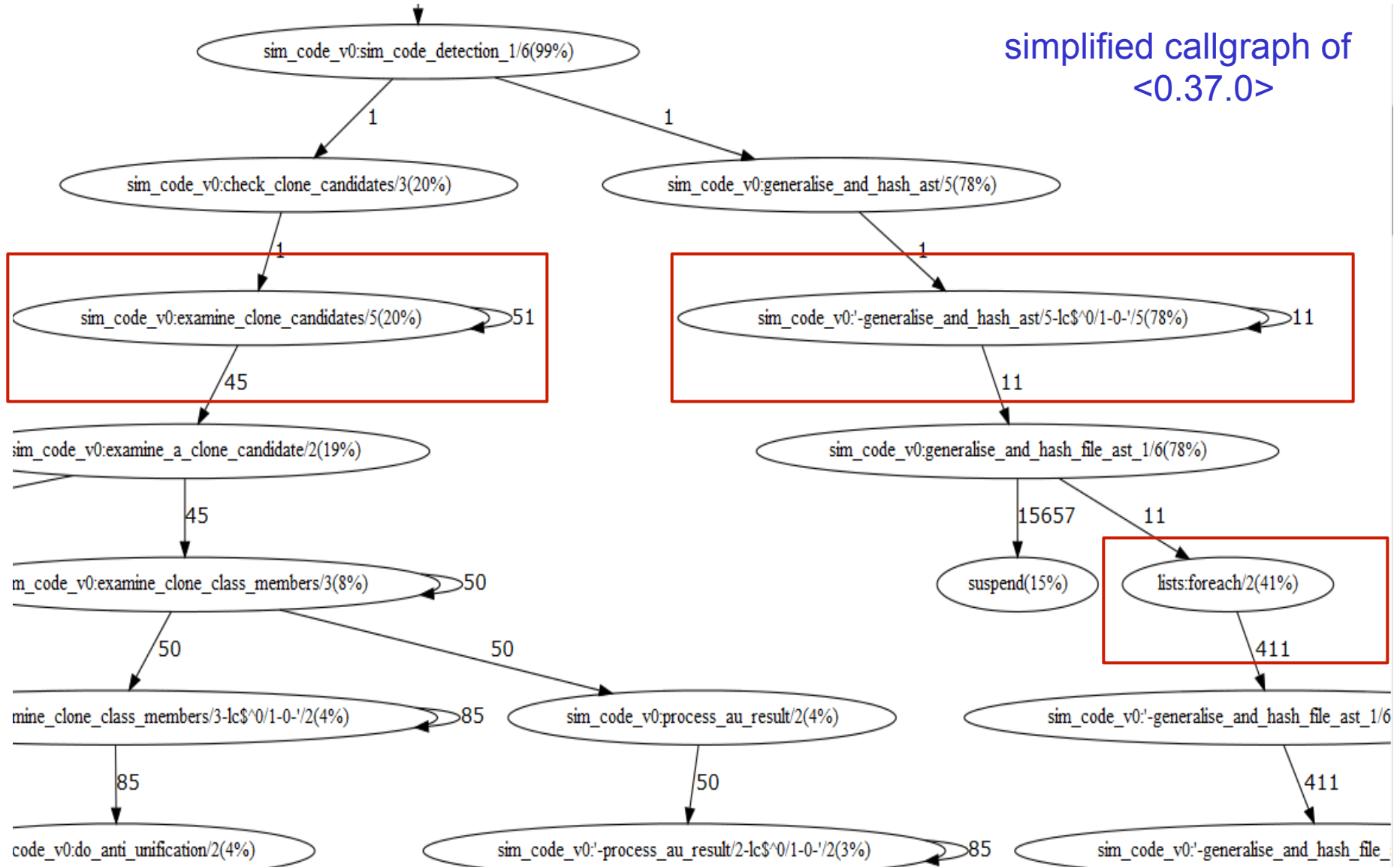
```
lists:foreach(fun (Form) -> F (Form) end, Forms)
```



```
para_lib:foreach(  
  fun (Form) -> F (Form) end, Forms, ?Parallel)
```

Percept2: case study

simplified callgraph of
<0.37.0>



Refac #3: recursive function to parallel 'foreach'

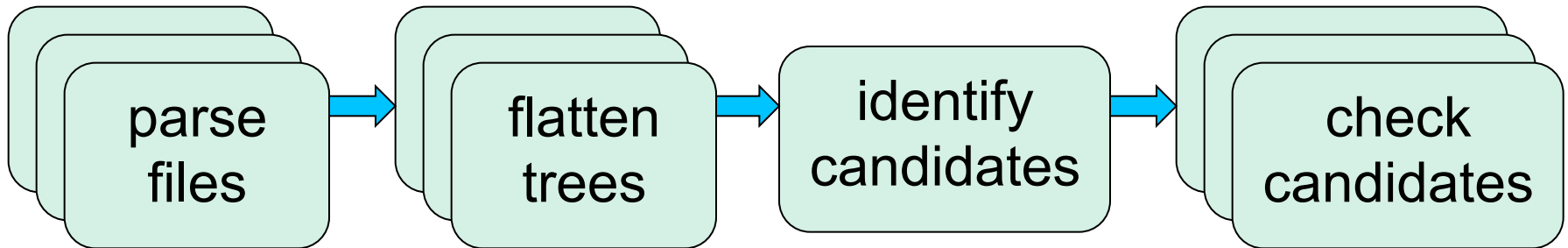
```
examine_clone_candidates([],_Thresholds,CloneCheckerPid,_Num) ->
  get_final_clone_classes(CloneCheckerPid);
examine_clone_candidates([C|Cs],Thresholds,CloneCheckerPid,Num) ->
  output_progress_msg(Num),
  NewClones = examine_a_clone_candidate(C, Thresholds),
  add_new_clones(CloneCheckerPid, {C, NewClones}),
  examine_clone_candidates(Cs,Thresholds,CloneCheckerPid,Num+1).
```



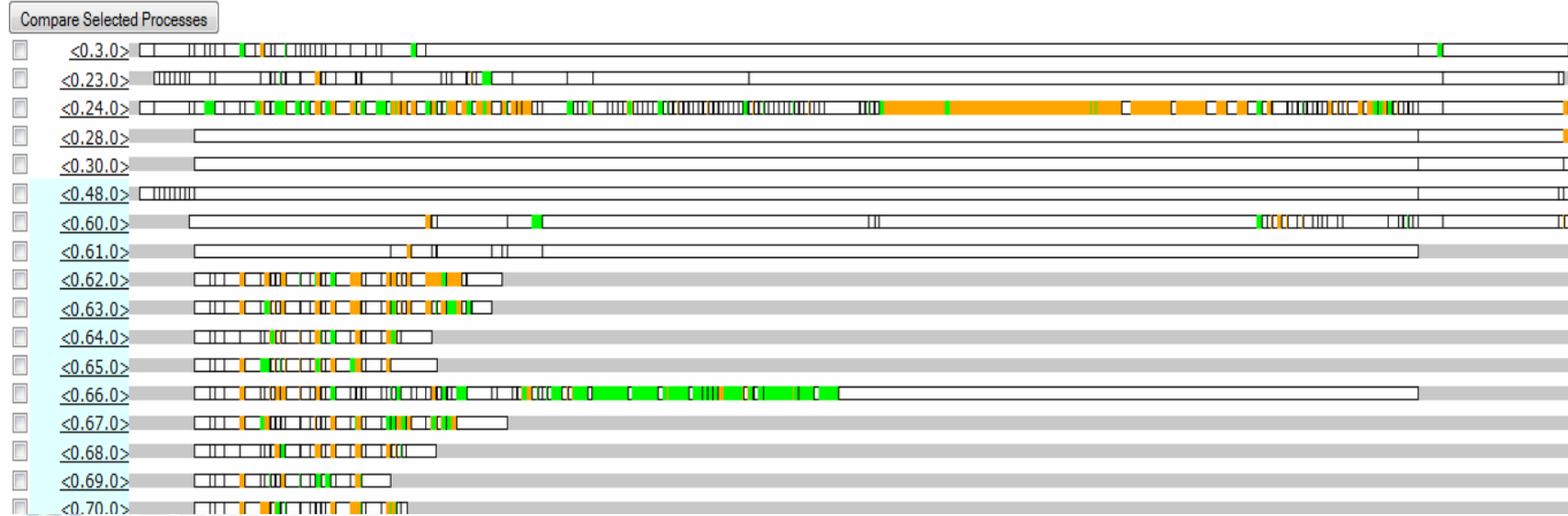
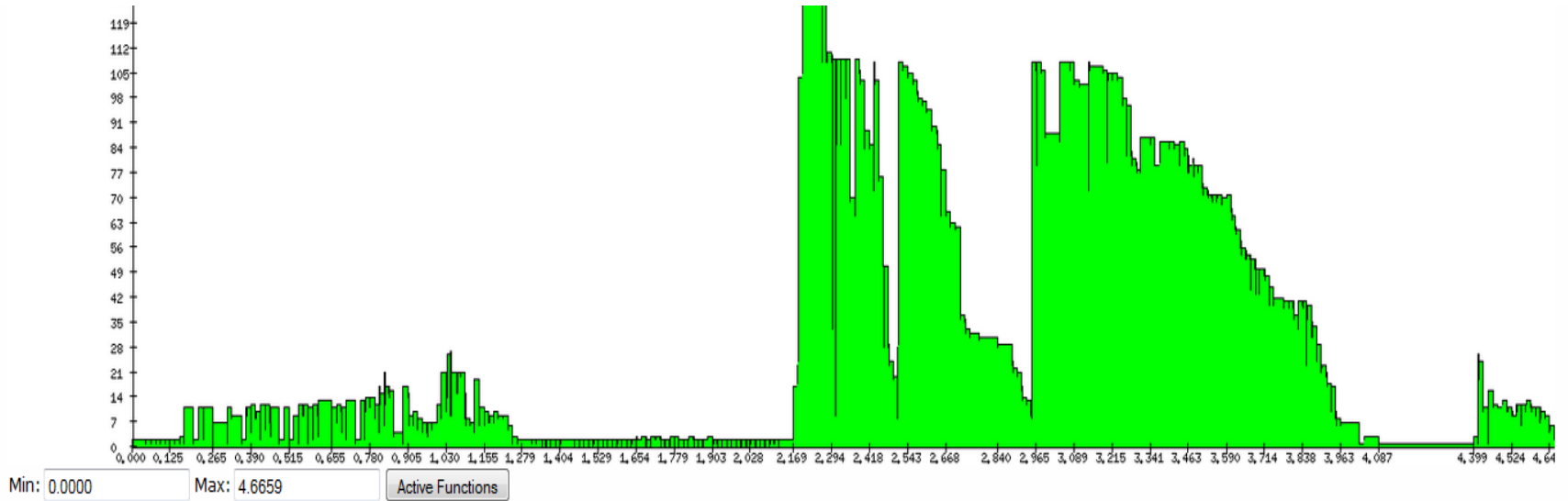
```
examine_clone_candidates(Cs, Thresholds, CloneCheckerPid) ->
  NumberedCs = lists:zip(Cs, lists:seq(1, length(Cs))),
  para_lib:pforeach(fun({C, Nth}) ->
    examine_a_clone_candidate(
      {C,Nth},Thresholds,CloneCheckerPid)
  end,NumberedCs),
  get_final_clone_classes(CloneCheckerPid).
examine_a_clone_candidate({C,Nth},Thresholds,CloneCheckerPid) ->
  output_progress_msg(Nth),
  NewClones = examine_a_clone_candidate(C, Thresholds),
  add_new_clones(CloneCheckerPid, {C, NewClones}).
```

Percept2: case study

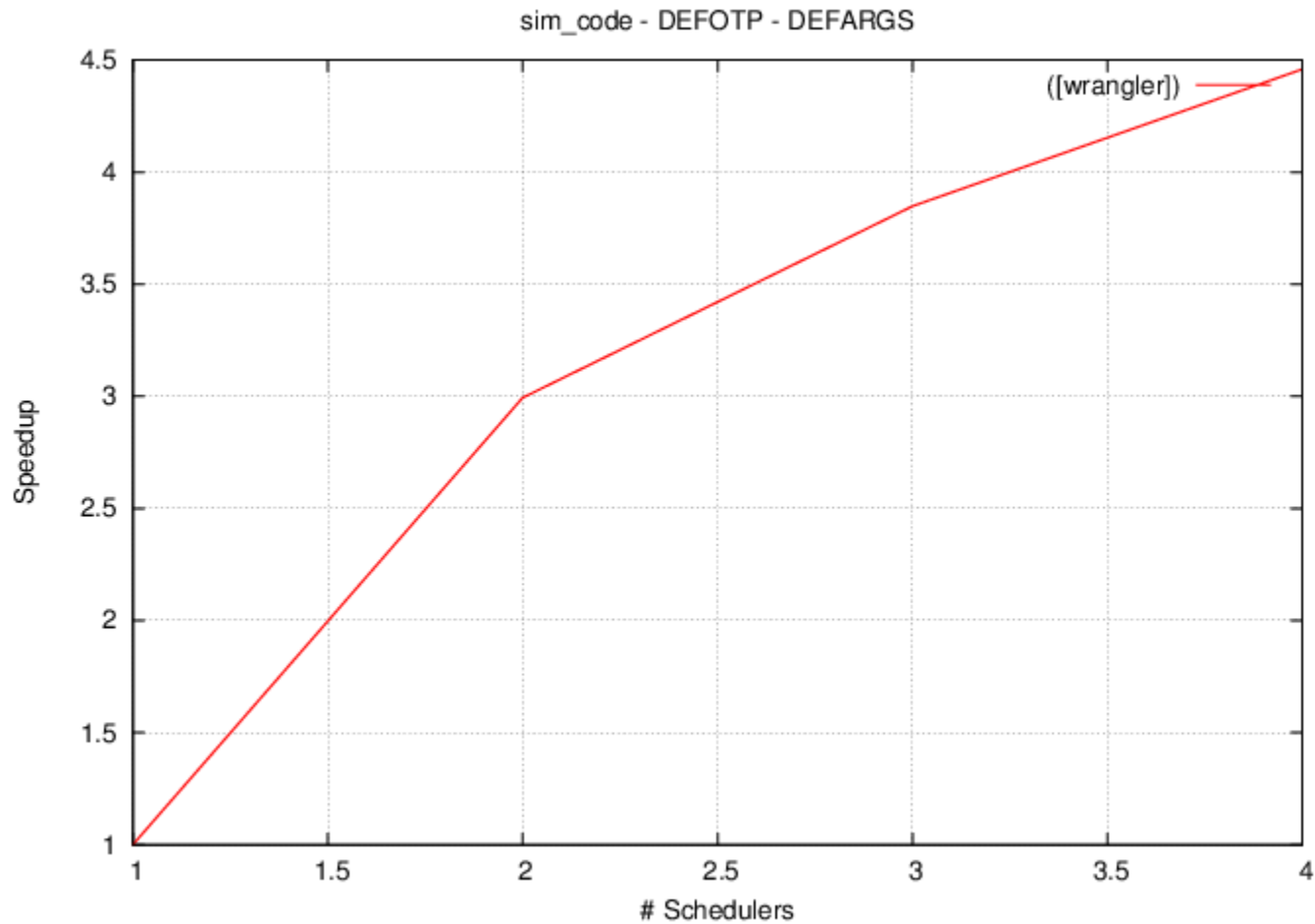
Clone detection in Wrangler



Percept2: case study



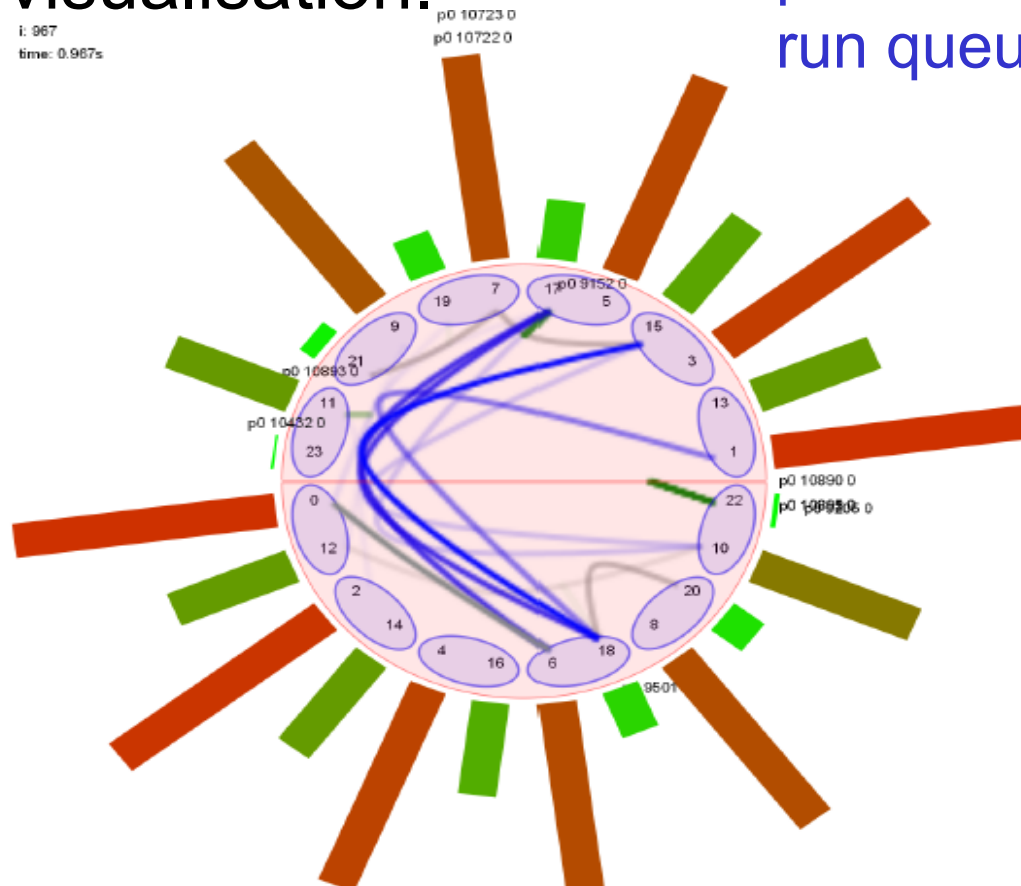
Percept2: case study



Other ongoing work

- Online visualisation.

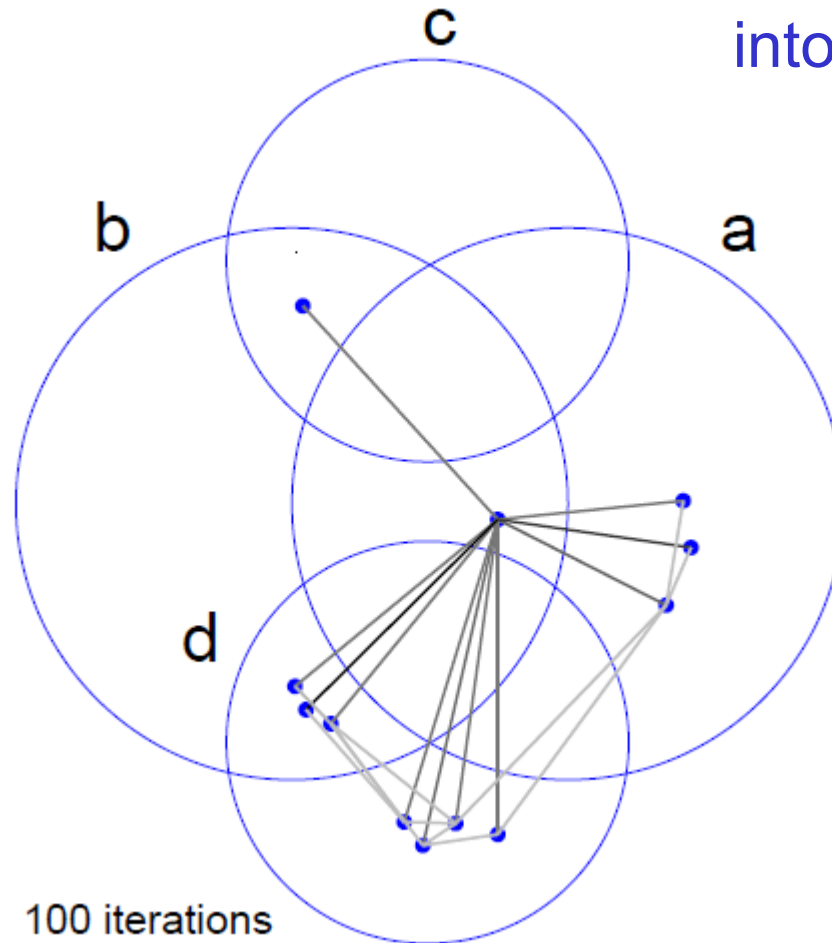
process migration and
run queue size



Other ongoing work

- Online visualisation.

interaction between Erlang nodes grouped into s_groups.



Conclusions

- RELEASE project
- A tool for profiling concurrent/parallel Erlang applications.
- Thanks to the Percept team!

Percept2

Get involved!

`git://github.com/huiqing/percept2.git`