

Interpreter composition



Edd Barrett



Carl
Friedrich
Bolz



Lukas
Diekmann



Laurence
Tratt



Naveneetha
Krishnan
Vasudevan

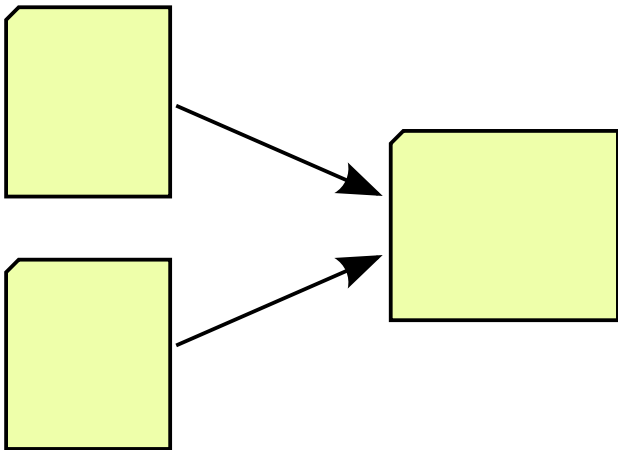


Software Development Team
2015-02-04

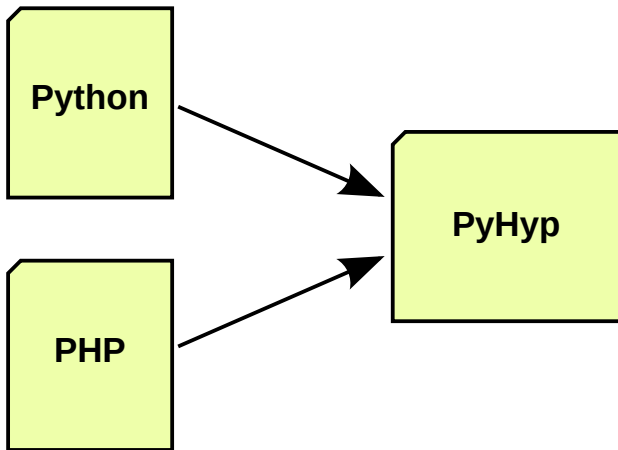
DSLs

DSLs

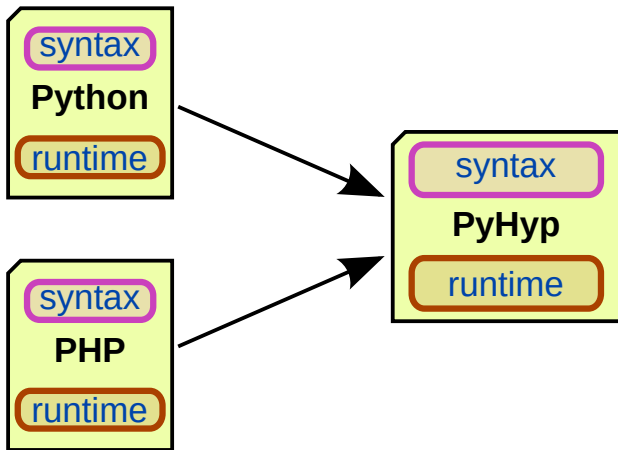
Language composition challenges



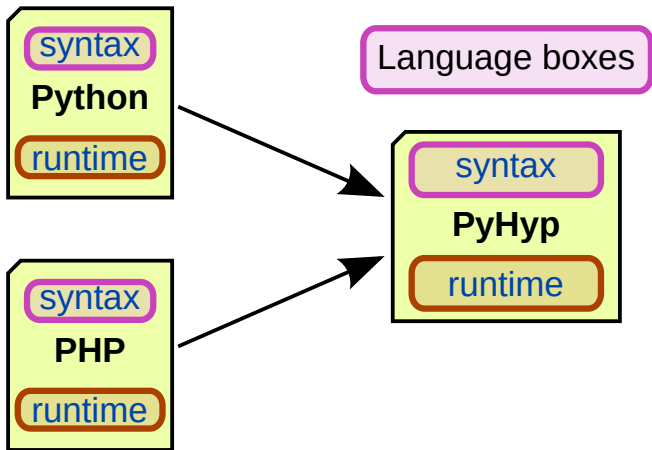
Language composition challenges



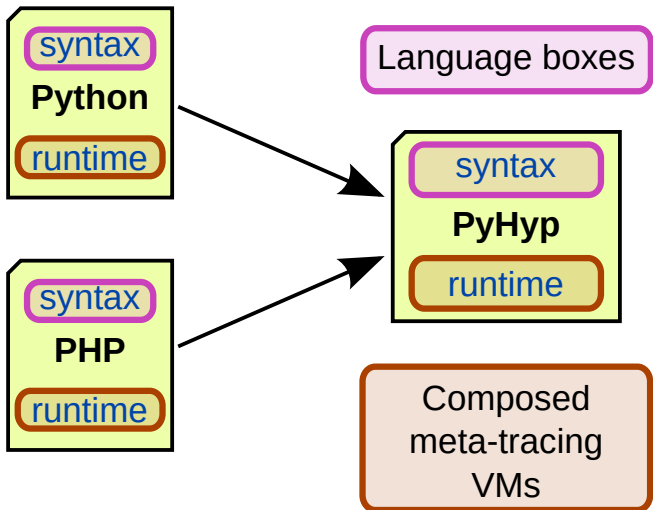
Language composition challenges



Language composition challenges

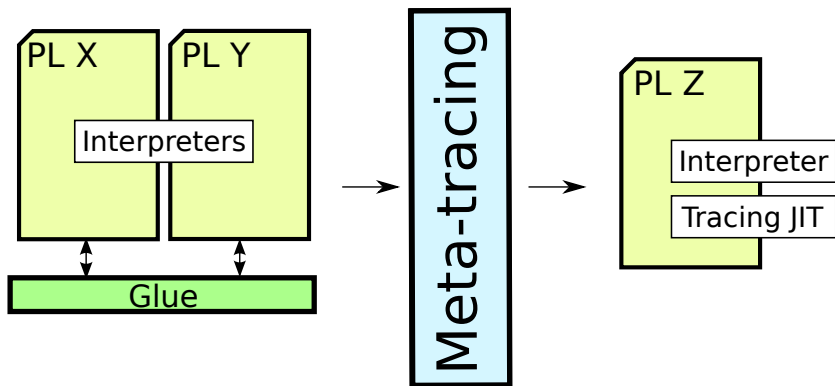


Language composition challenges

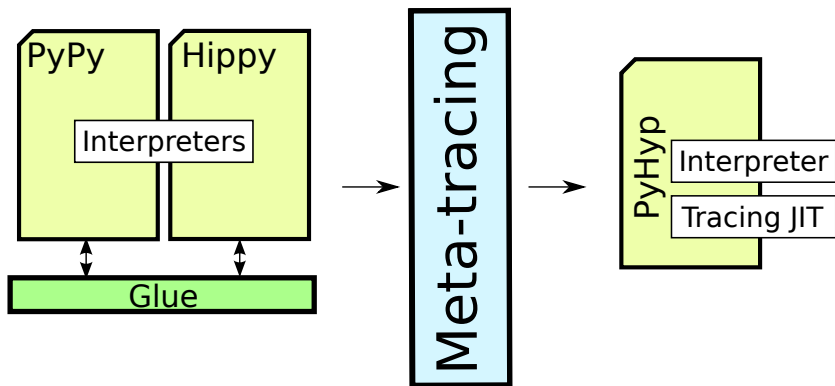


Meta-tracing interpreter composition

Meta-tracing interpreter composition



Meta-tracing interpreter composition



Warning: draft numbers ahead!

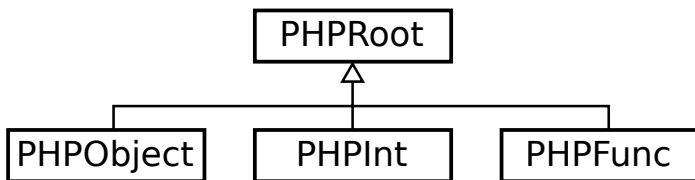
Composed Richards vs. other VMs

Type	VM	
Mono	PyPy 2.4.0	1.491 \pm 0.005
	HippyVM	2.040 \pm 0.005
	PyHyp	1.960 \pm 0.004
	HHVM 3.4.0	34.190 \pm 0.443
	Zend 5.5.13	72.758 \pm 0.126

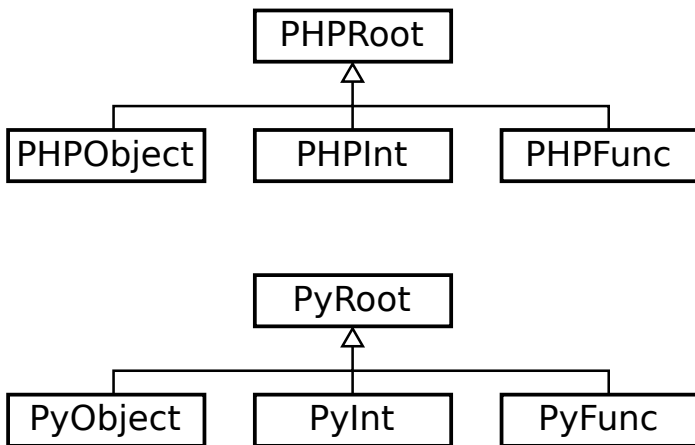
Composed Richards vs. other VMs

Type	VM	
Mono	PyPy 2.4.0	1.491 \pm 0.005
	HippyVM	2.040 \pm 0.005
	PyHyp	1.960 \pm 0.004
	HHVM 3.4.0	34.190 \pm 0.443
	Zend 5.5.13	72.758 \pm 0.126
Composed	PyHyp	2.182 \pm 0.004

Datatype conversion



Datatype conversion



Datatype conversion: primitive types

PHP

Python

Datatype conversion: primitive types

PHP

2 : PHPInt

Python

Datatype conversion: primitive types

PHP

2 : PHPInt

Python

2 : PyInt

Datatype conversion: user types

PHP

Python



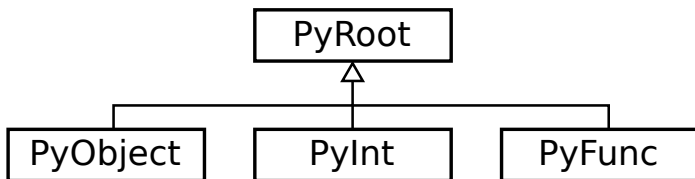
Datatype conversion: user types

PHP

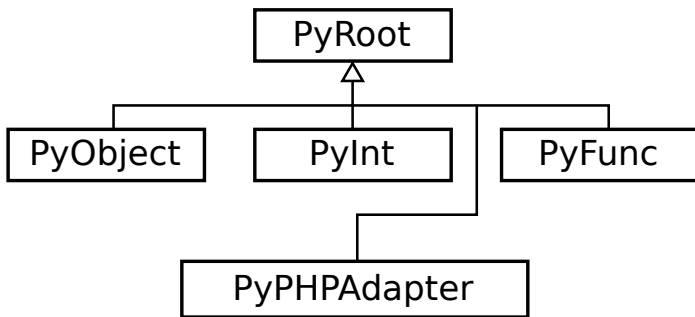
`o : PHPObject`

Python

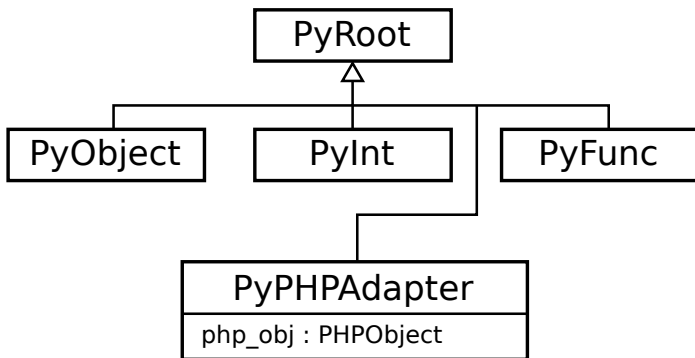
Datatype conversion: user types



Datatype conversion: user types



Datatype conversion: user types



Datatype conversion: user types

PHP

`o : PHPObject`

Python

Datatype conversion: user types

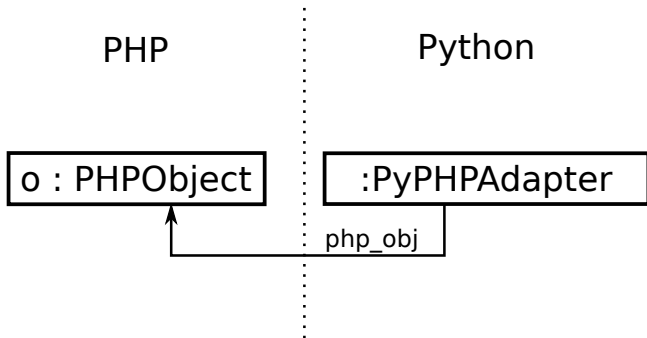
PHP

`o : PHPObject`

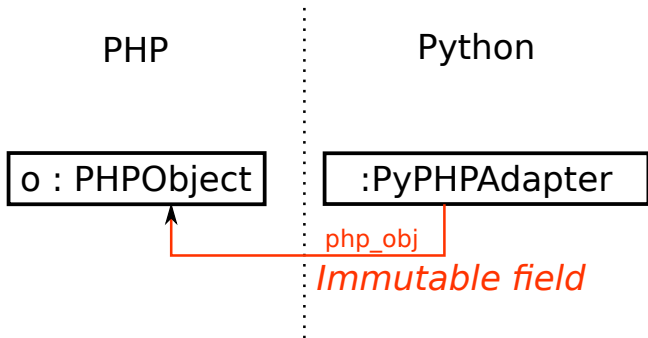
Python

`:PyPHPAdapter`

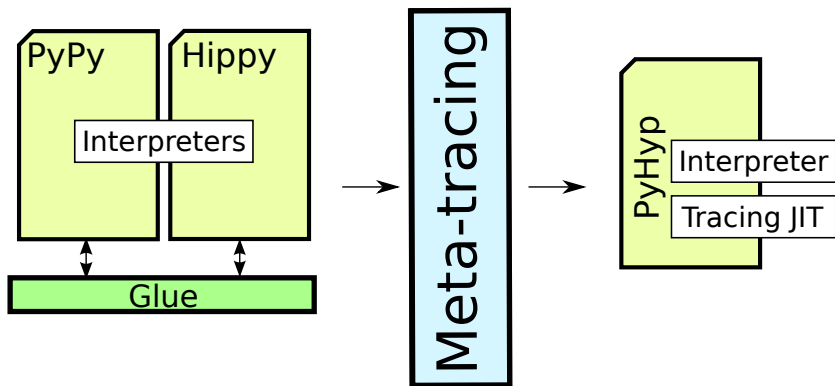
Datatype conversion: user types



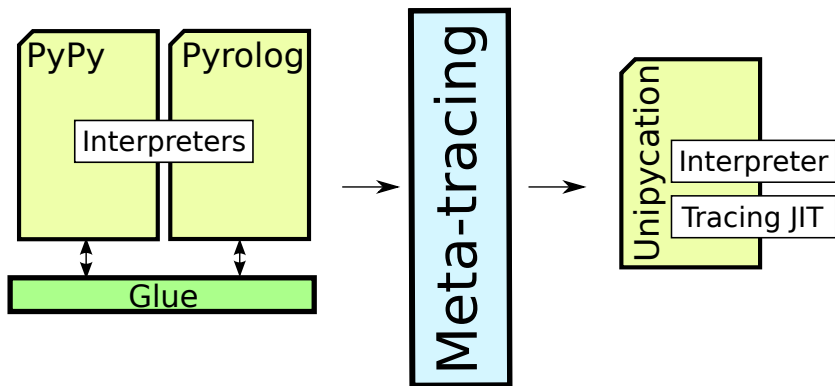
Datatype conversion: user types



Unipycation



Unipycation



Absolute timing comparison

VM	Benchmark	<i>Python</i>		<i>Prolog</i>		<i>Python</i> → <i>Prolog</i>	
CPython-SWI	SmallFunc	0.125s	±0.006	0.257s	±0.001	28.893s	±0.175
	Loop1Arg0Result	2.924s	±0.215	7.352s	±0.037	9.310s	±0.065
	Loop1Arg1Result	4.184s	±0.028	18.890s	±0.082	20.865s	±0.050
	NondetLoop1Arg1Result	7.531s	±0.065	18.643s	±0.159	667.682s	±5.594
	TermConstruction	264.415s	±1.815	48.819s	±0.208	2185.150s	±14.251
	Lists	9.374s	±0.046	25.148s	±0.182	2207.304s	±12.344
Unipycation	SmallFunc	0.001s	±0.000	0.006s	±0.001	0.001s	±0.000
	Loop1Arg0Result	0.085s	±0.000	0.086s	±0.000	0.087s	±0.000
	Loop1Arg1Result	0.112s	±0.000	0.114s	±0.000	0.115s	±0.000
	NondetLoop1Arg1Result	0.500s	±0.002	0.548s	±0.064	2.674s	±0.010
	TermConstruction	6.053s	±0.218	2.444s	±0.002	36.069s	±0.171
	Lists	0.845s	±0.002	1.416s	±0.003	5.056s	±0.026
Jython-tuProlog	SmallFunc	0.088s	±0.002	3.050s	±0.036	52.294s	±0.371
	Loop1Arg0Result	1.078s	±0.007	206.590s	±2.884	199.963s	±1.784
	Loop1Arg1Result	2.145s	±0.175	293.311s	±4.270	294.781s	±4.746
	NondetLoop1Arg1Result	7.939s	±0.341	timeout		timeout	
	TermConstruction	timeout		timeout		timeout	
	Lists	timeout		timeout		timeout	

Relative timing comparison

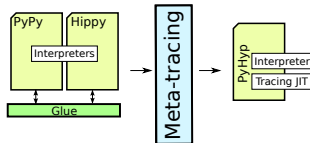
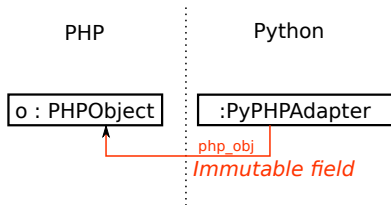
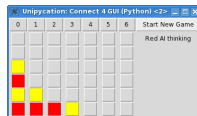
VM	Benchmark	$\frac{\text{Python} \rightarrow \text{Prolog}}{\text{Python}}$		$\frac{\text{Python} \rightarrow \text{Prolog}}{\text{Prolog}}$		$\frac{\text{Python} \rightarrow \text{Prolog}}{\text{Unipycation}}$	
CPython-SWI	SmallFunc	231.770 ×	±10.154	112.567 ×	±0.934	27821.079 ×	±1896.725
	Loop1Arg0Result	3.184 ×	±0.232	1.266 ×	±0.011	107.591 ×	±0.779
	Loop1Arg1Result	4.987 ×	±0.039	1.105 ×	±0.006	181.899 ×	±0.444
	NondetLoop1Arg1Result	88.654 ×	±1.026	35.814 ×	±0.389	249.737 ×	±2.244
	TermConstruction	8.264 ×	±0.081	44.760 ×	±0.348	60.583 ×	±0.487
	Lists	235.459 ×	±1.742	87.772 ×	±0.789	436.609 ×	±3.494
Unipycation	SmallFunc	1.295 ×	±0.086	0.182 ×	±0.036	1.000 ×	
	Loop1Arg0Result	1.020 ×	±0.001	1.012 ×	±0.002	1.000 ×	
	Loop1Arg1Result	1.025 ×	±0.002	1.002 ×	±0.002	1.000 ×	
	NondetLoop1Arg1Result	5.349 ×	±0.035	4.879 ×	±0.631	1.000 ×	
	TermConstruction	5.959 ×	±0.224	14.756 ×	±0.069	1.000 ×	
	Lists	5.982 ×	±0.034	3.569 ×	±0.019	1.000 ×	
Jython-tuProlog	SmallFunc	592.904 ×	±14.602	17.143 ×	±0.259	50354.204 ×	±3330.993
	Loop1Arg0Result	185.460 ×	±2.182	0.968 ×	±0.017	2310.844 ×	±21.996
	Loop1Arg1Result	137.427 ×	±11.805	1.005 ×	±0.022	2569.873 ×	±41.331
	NondetLoop1Arg1Result	timeout		timeout		timeout	
	TermConstruction	timeout		timeout		timeout	
	Lists	timeout		timeout		timeout	

Thanks to our funders

- EPSRC: *COOLER* and *Lecture*.
- Oracle: various.

Thanks for listening

```
1: <html>
2: <head>
3: <import sqlite3
4: c = sqlite3.connect("/home/ltratt/scratch/demo/test.db")
5: </head>
6: <body>
7: <h1>hello</h1>
8: for n, in SELECT name FROM people:
9:     print n
10: </body>
11: </html>
```



<http://soft-dev.org/>