

Phylanx

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Phylanx

- An asynchronous array computing toolkit
- Computation on large distributed array
- Built on top of HPX
- High level programming interface
- Write once run everywhere

Phylanx: Execution Tree

- Tree consisting of primitives operating over data objects
- Primitives
 - Basic operations
 - NumPy function
 - External
- Data
 - 0D: scalar of basic C++ types
 - 1D, 2D: Blaze (vector, matrix)

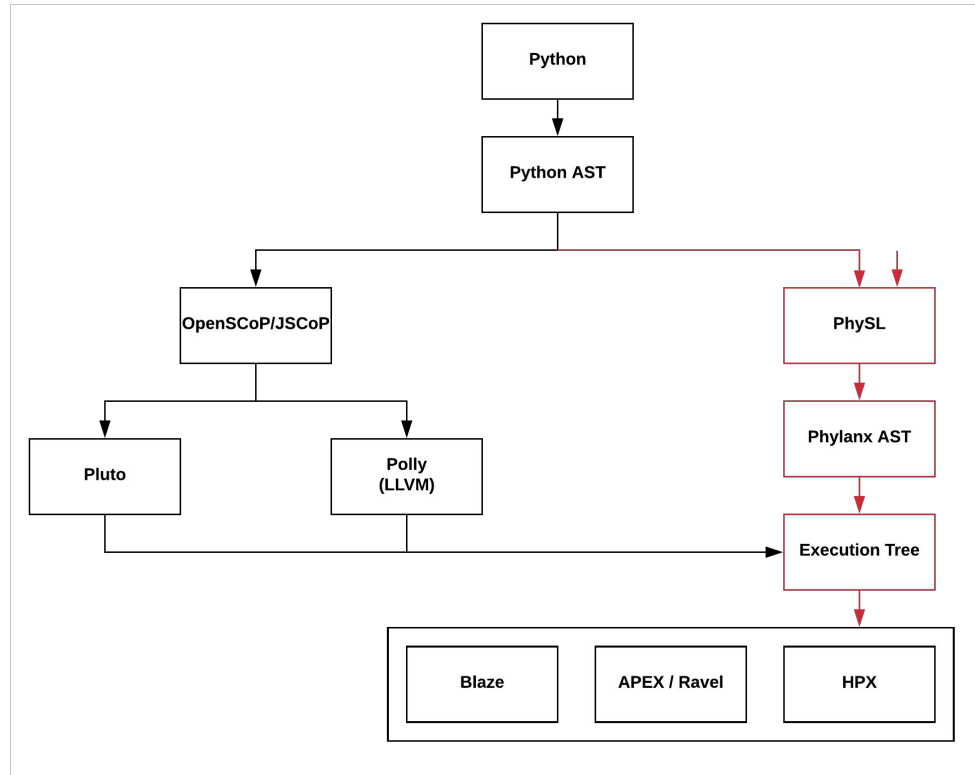
Phylanx: AST

- Nodes
 - Operands, identifiers
 - Expressions, primary expressions, unary expressions
 - Function calls, operations
- Transformations
 - Data
 - Computation

Phylanx: Front-end

- PhySL
 - Interpreter
 - IR
 - Transformation rules
- Python
 - Decorators
 - Jupyter
 - AST

Phylanx: Default Program Flow



Example

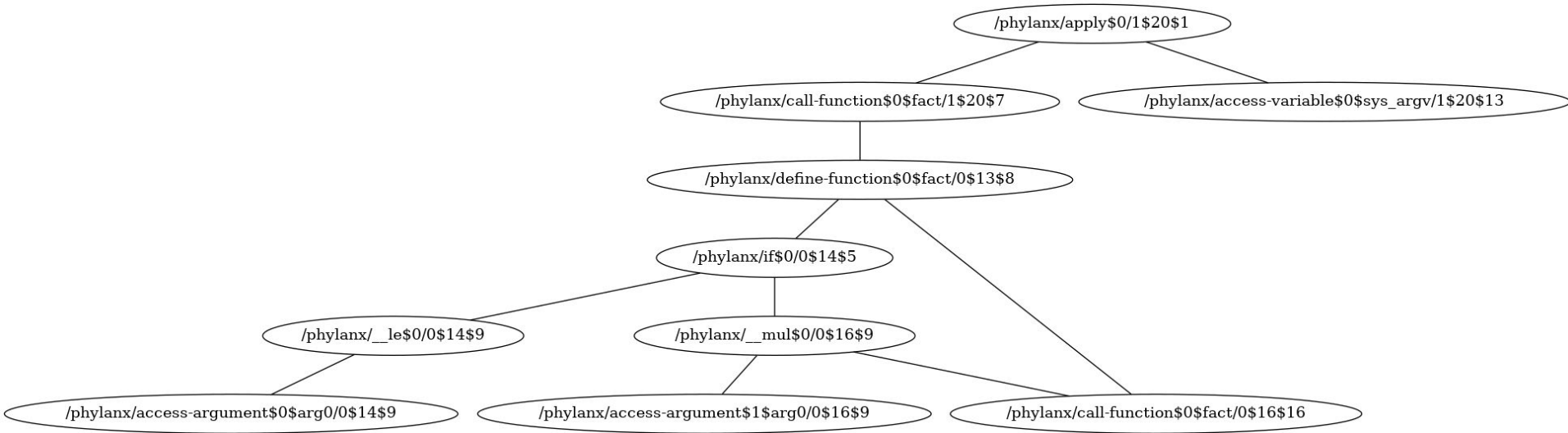
```

1 define(fact, arg0,
2     if (arg0 <= 1,
3         1,
4         arg0 * fact(arg0 - 1)
5     )
6 )
7
8 apply(fact, sys_argv)
-
1 from phylanx.ast.oscop import *
2 from phylanx.ast.transformation import Phylanx
3
4 @Phylanx()
5 def factorial(a):
6     if a <= 1:
7         return 1
8     else:
9         return factorial(a-1)
10
11
12 print(factorial(3))
13 print(factorial.__src__)

```

```
define$6$0(factorial$6$0, a$6$14, if$7$4((a$7$7 <= 1), 1, factorial$10$15((a$10$25 - 1))))
```

Example: Execution Tree



Example: Custom Transformation Rules

```

1 define(add, a, b,
2     block(
3         define(result, (a*b)),
4         result
5     )
6 )
7
8 apply(add, sys_argv)
  
```

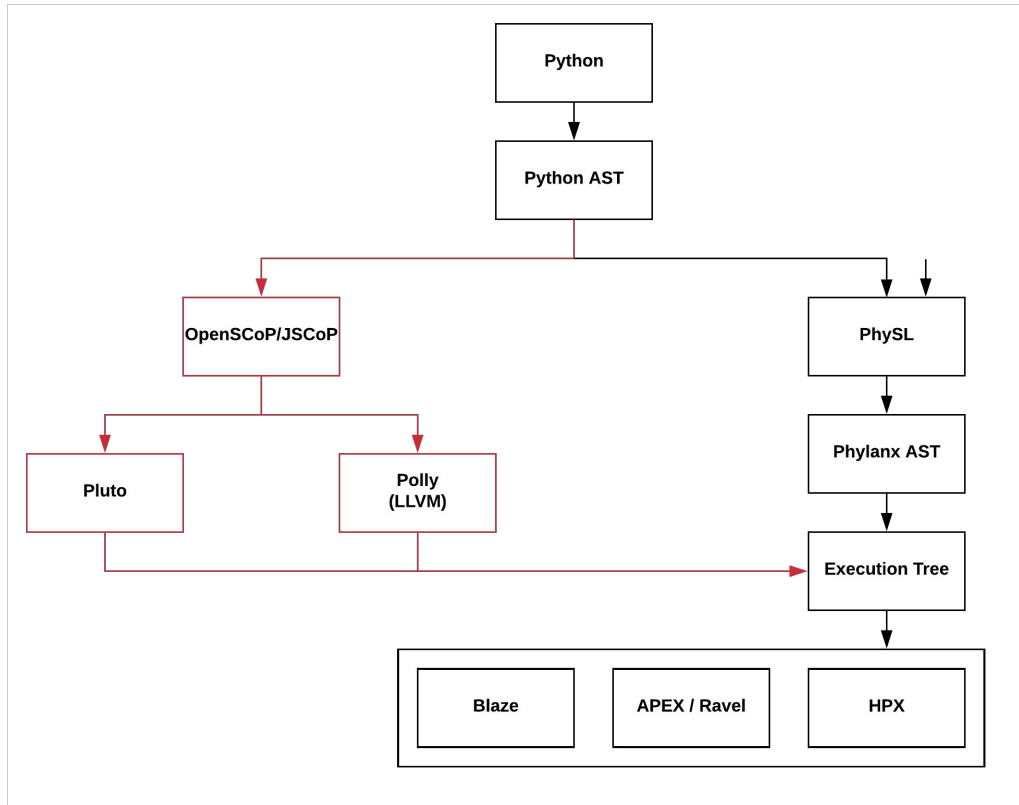
```

1 // transform all multiplications into subtraction
2 _1 * _2 : _1 - _2
  
```

Polyhedral Transformations

- Polyhedral Model
 - Applicable to SCoP
 - a maximal set of consecutive statements, where loop bounds and conditionals are affine functions of the surrounding loop iterators and the parameters.
- OpenSCoP
 - An open specification.
 - Defines a file format and a set of data structures to represent a SCoP.
 - Provides a common interface to various polyhedral tools.

OpenSCoP



Summary

- Native
 - Data decomposition
 - Tree transducer

- External Tools
 - Regular Applications (Polyhedral)
 - Irregular Applications (indirections)

Thank you!