Numba

Python compiler for NumPy/SciPy

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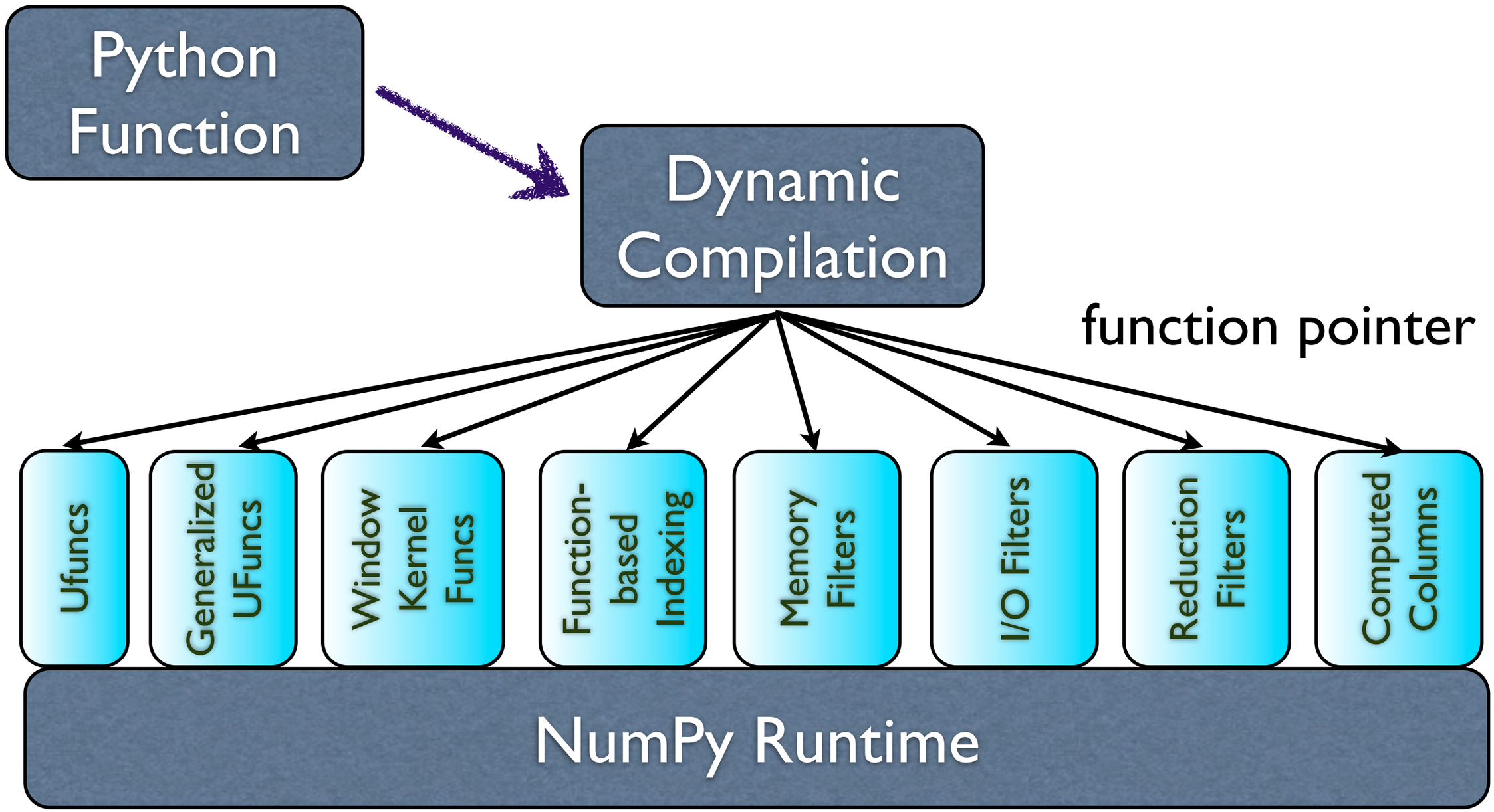
NumPy Users

- Want to be able to write Python to get fast code that works on arrays and scalars
- Need access to a boat-load of C-extensions (NumPy is just the beginning)

PyPy doesn't cut it for us!

Dynamic compilation



CONTINUUM ANALYTICS

SciPy needs a Python compiler

optimize

integrate

special

ode

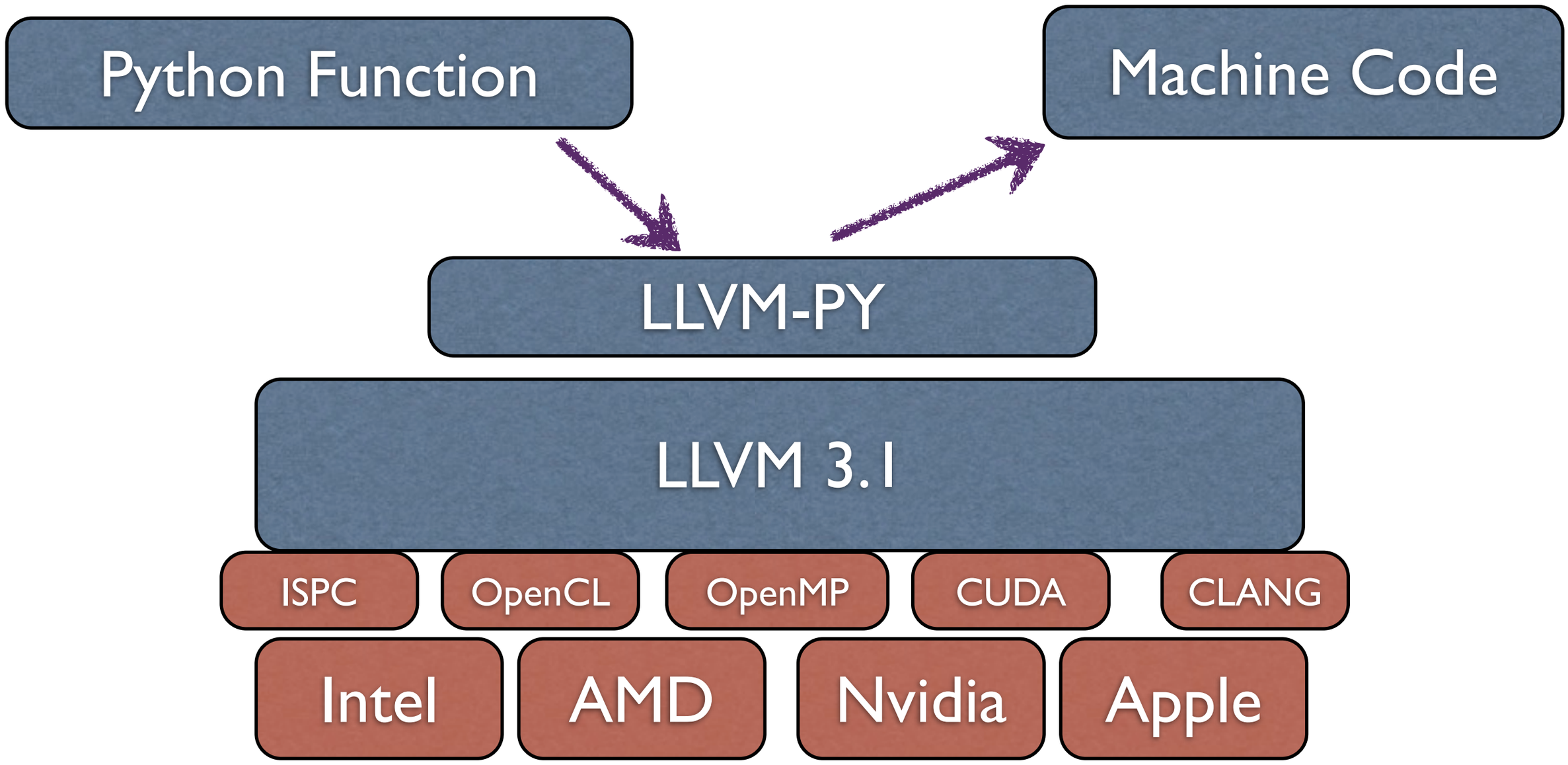
writing more of SciPy at high-level

CONTINUUM ANALYTICS

Numba -- a Python compiler

- Replays byte-code on a stack with simple type-inference
- Translates to LLVM (using LLVM-py)
- Uses LLVM for code-gen
- Resulting C-level function-pointer can be inserted into NumPy run-time
- Understands NumPy arrays
- Is NumPy / SciPy aware

NumPy + Mamba = Numba



CONTINUUM ANALYTICS

Examples

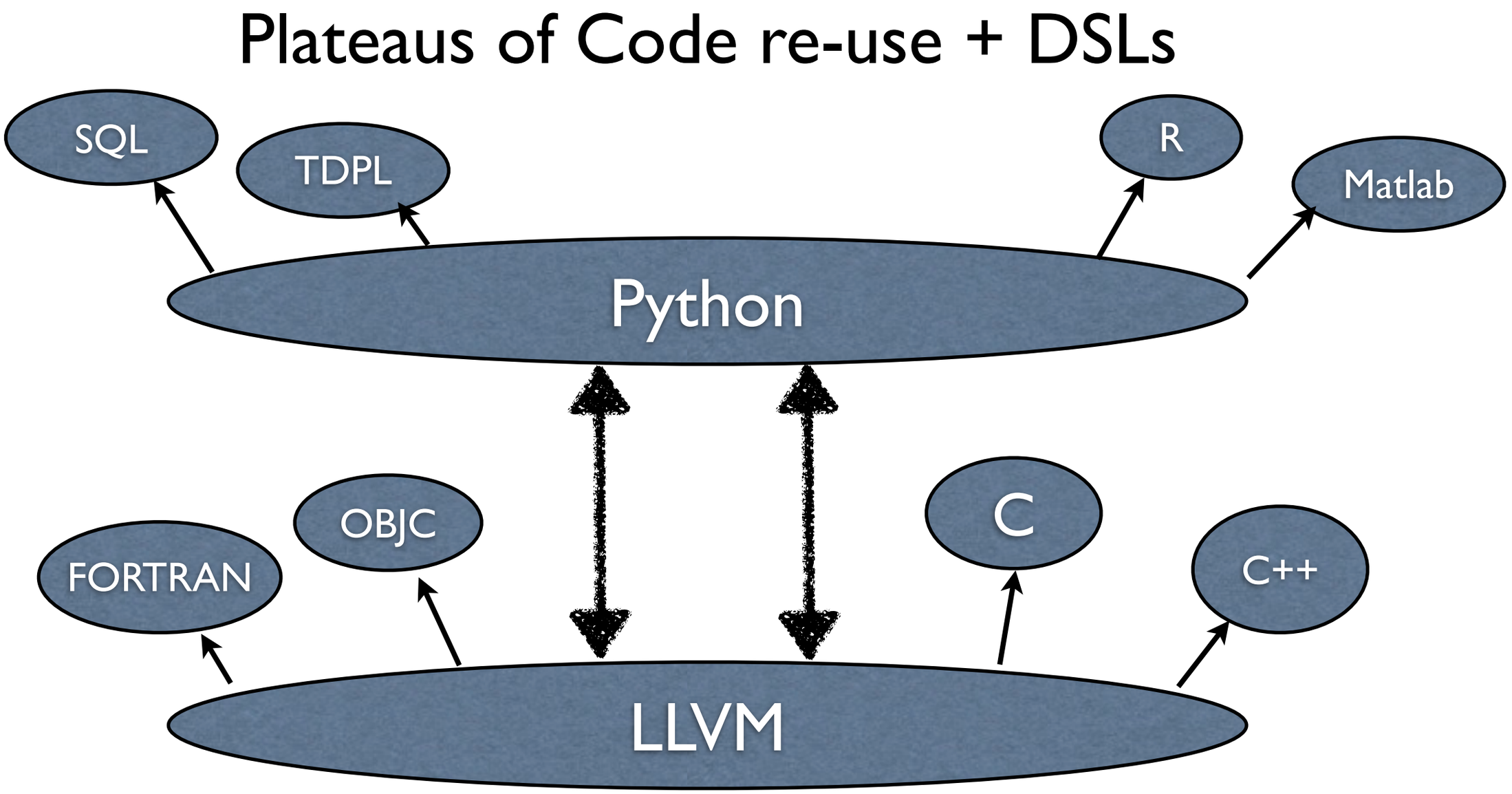
```
define double @sinc(double %x) {
Entry:
  %0 = fcmp oeq double %x, 0.000000e+00
  br i1 %0, label %CONT_9, label %IF_FALSE_9

CONT_9:                                           ; preds = %Entry
  ret double 1.000000e+00

IF_FALSE_9:                                       ; preds = %Entry
  %1 = fmul double %x, 0x400921FB54442D18
  %2 = call double @llvm.sin.f64(double %1)
  %3 = fmul double 0x400921FB54442D18, %x
  %4 = fdiv double %2, %3
  ret double %4

RETURN_37:                                        ; No predecessors!
  ret double 0.000000e+00
}

declare double @llvm.sin.f64(double) nounwind readonly
```

```
@vectorize
def sinc(x):
    if x==0.0:
        return 1.0
    else:
        return sin(x*pi)/(pi*x)
```

Examples

```
@numba.compile
def filter2d(image, filt):
    M, N = image.shape
    Mf, Nf = filt.shape
    Mf2 = Mf // 2
    Nf2 = Nf // 2
    result = zeros_like(image)
    for i in range(Mf2, M-Mf2):
        for j in range(Nf2, N-Nf2):
            num = 0.0
            for ii in range(Mf):
                for jj in range(Nf):
                    num += filt[Mf-1-ii, Nf-1-jj] * image[i-Mf2+ii, j-Nf2+jj]
            result[i, j] = num
    return result
```

Software Stack Future?



CONTINUUM ANALYTICS

Seeking Developers!

https://github.com/ContinuumIO/numba