Awkward Arrays to RDataFrame and back

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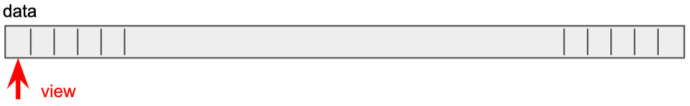
Awkward Arrays and RDataFrame provide two very different ways of performing calculations at scale. By adding the ability to zero-copy convert between them, users get the best of both. It gives users a better flexibility in mixing different packages and languages in their analysis.

The *ak.to_rdataframe* function presents a view of an Awkward Array as an RDataFrame source. This view is generated on demand and the data is not copied. The column readers are generated based on the run-time type of the views. The readers are passed to a generated source derived from *ROOT::RDF::RDataSource*.

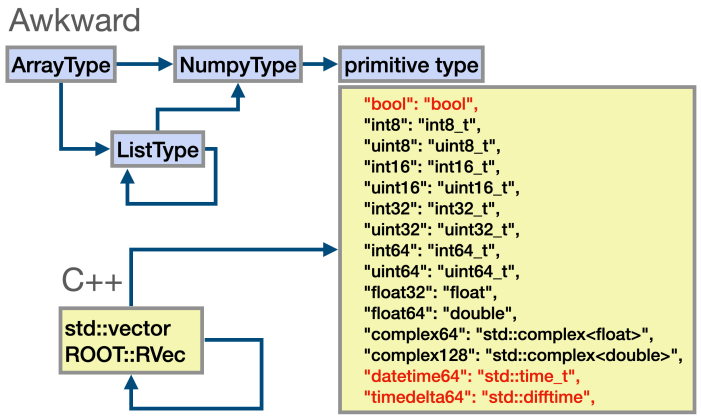
- Generated AwkwardArray RDataSource takes pointers into the original array data: a 40-byte ArrayView object is allocated on the stack
- The large-scale array data are not copied
- The views are transient, their lifetime is defined by the lifetime of their lookup Python object



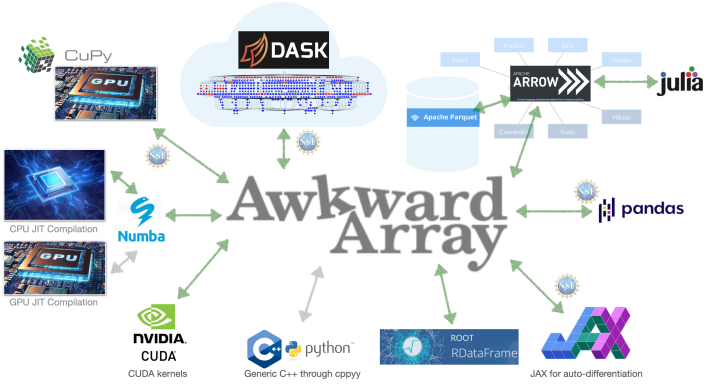
- ArrayViews keep a pointer to their lookup Python object to facilitate a no-copy conversion back to an Awkward Array

The implementation is exploiting JIT techniques. Constructing the Awkward Arrays from the RDataFrame result pointers is fairly independent from ROOT.

The *ak.from_rdataframe* function converts the selected columns as native Awkward Arrays.



- A Pythonized by cppyy C++ header-only class converts the data to the Numpy-like buffers
- The C++ templated header-only implementation constructs the Form - i.e. the description of an Awkward Array - from the data types



See Manasvi's talk The Awkward World of Python and C++

Awkward RDataFrame Tutorial presented at the PyHEP 2022 Workshop shows examples of the column definition, applying user-defined filters written in C++, and plotting or extracting the columnar data as Awkward Arrays.

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