Adaptable framework LDRD update

https://indico.fnal.gov/event/52666/contributions/231769/attachments/153101/198580/SCDProjects_LDRD_Knoepfel.pdf

Kyle J. Knoepfel

Monthly DUNE/LDRD meeting

14 December 2022

Framework-supported algorithm constructs

Constructs that can be framework-agnostic:

- **Transform** (producer) – creates data products from existing data of the same processing level
- **Reduction** (producer) – creates data products based on accumulations of data at a more granular processing level (e.g. endSubRun)
- **Monitor** (analyzer) – consumes data products and does not produce any new data
- **Filter** – supports processing a subset of data based on satisfying Boolean criteria

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Constructs that must be framework-aware:

- **Source** – creates product stores that provide data products
- **Splitter** – splits existing product stores into smaller ones for downstream processing
- **Output** – writes product stores to an output file, stream, etc.

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DEFINE_MODULE(m) // pset can also be passed in
{
  m.declare_transform("add", add)
   .concurrency(unlimited)
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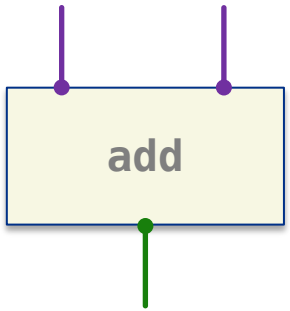
Generates graph node



Fermilab

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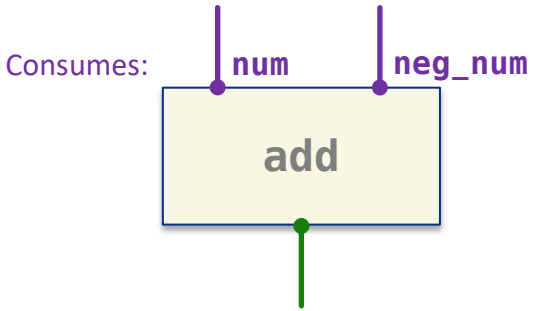

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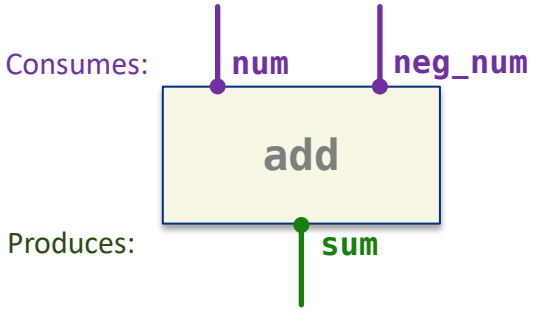

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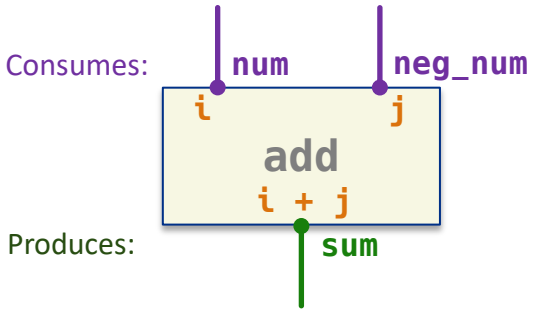

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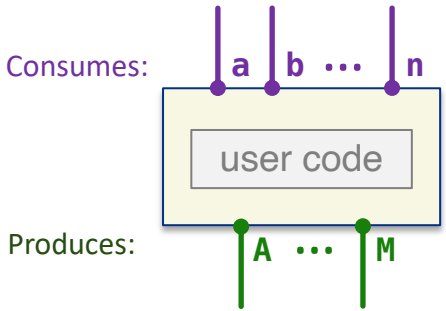
Graph nodes

- For *framework-agnostic constructs*, framework details **are not** accessed by the user within the node.



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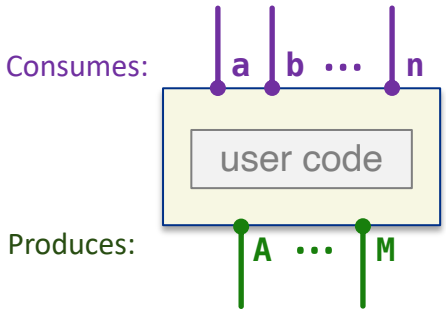
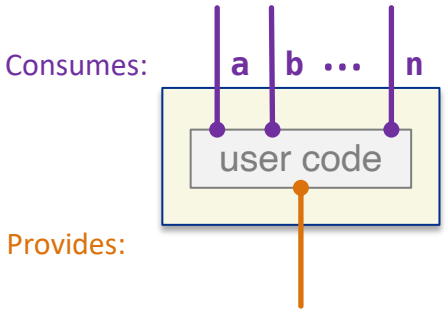


- For *framework-aware constructs*, framework details **must be** accessed by the user within the node.



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Data flow

- Communication between nodes occurs via messages, which contain either:
  - (a) a product store (black lines), or
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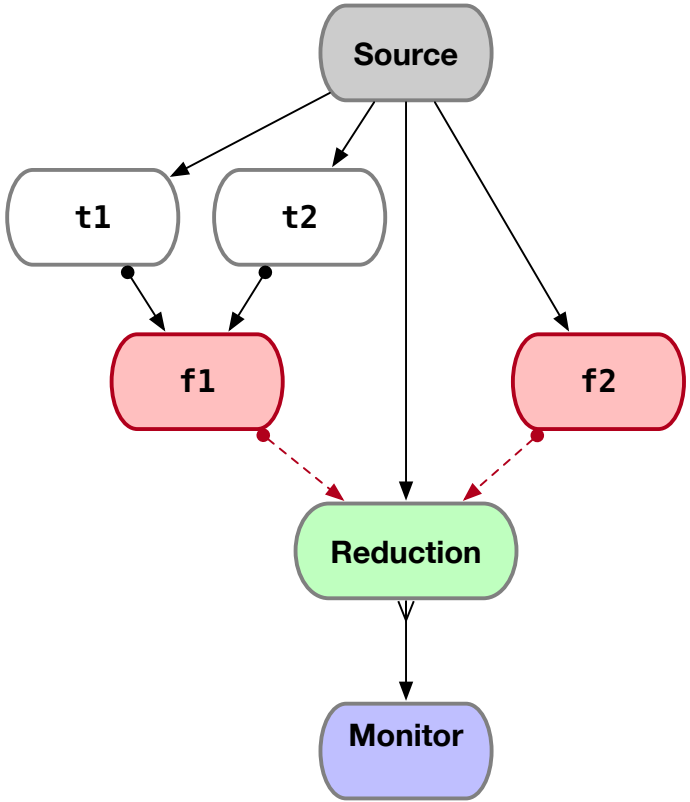

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- Communication between nodes occurs via messages, which contain either:
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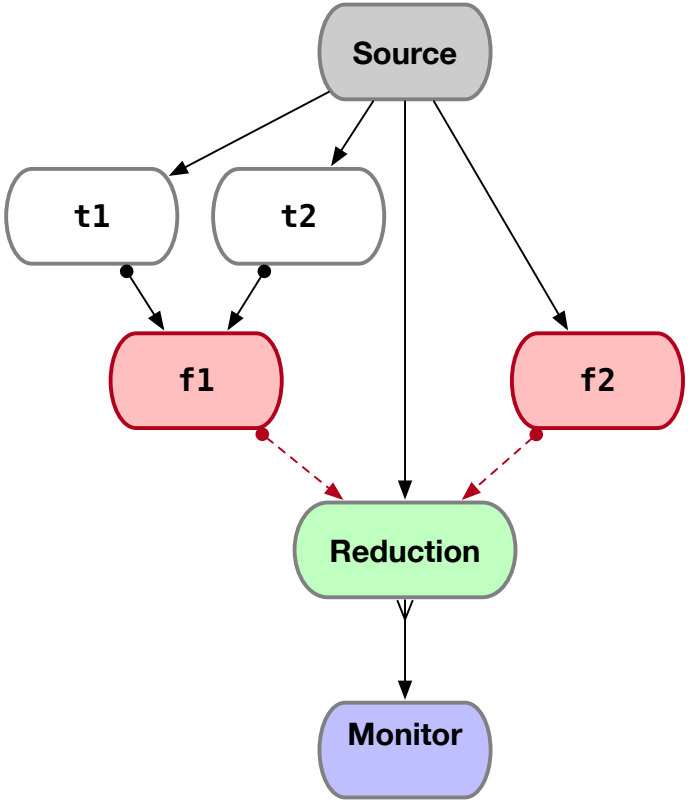
- Product stores are shallow—the products from one store are not propagated to downstream stores.

N.B. **Products are immutable once committed to the framework.**



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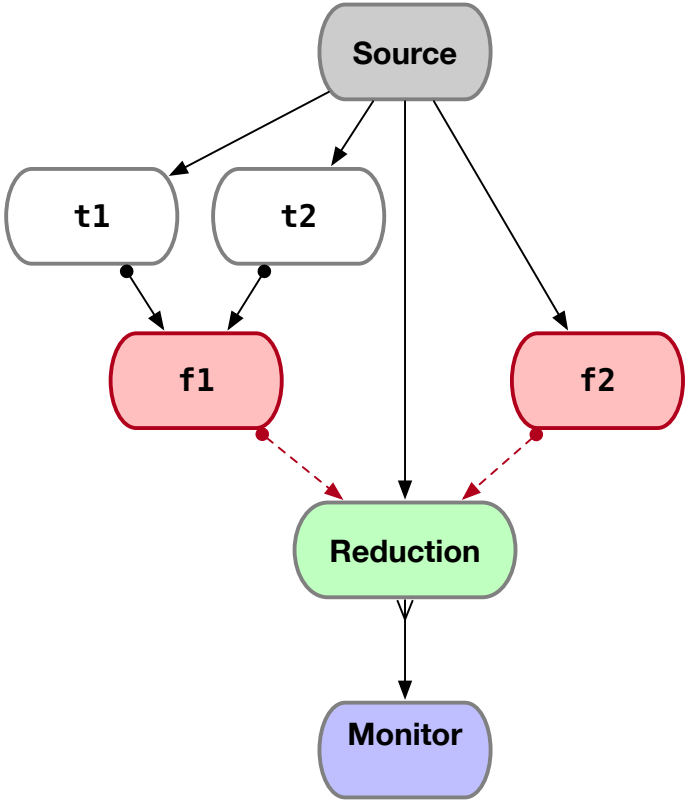

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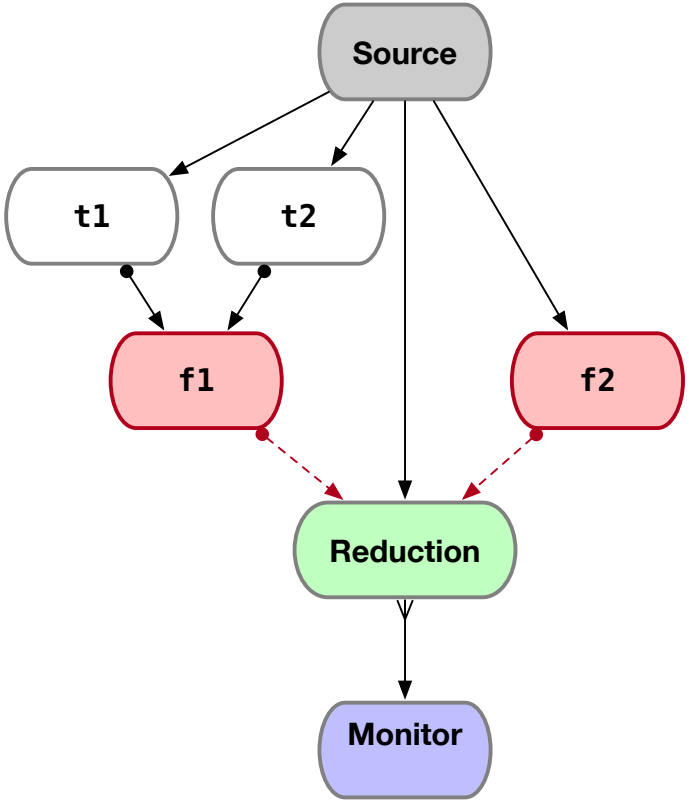

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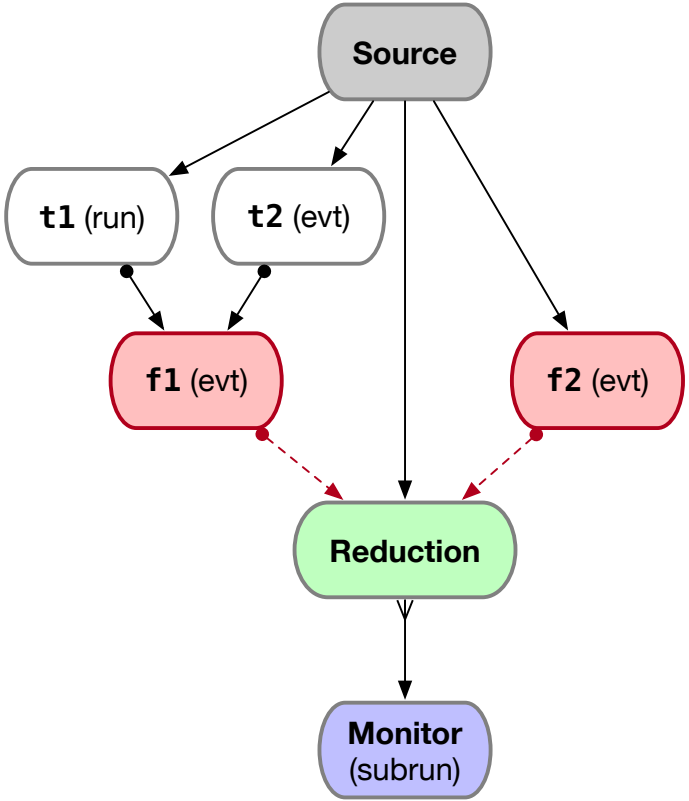
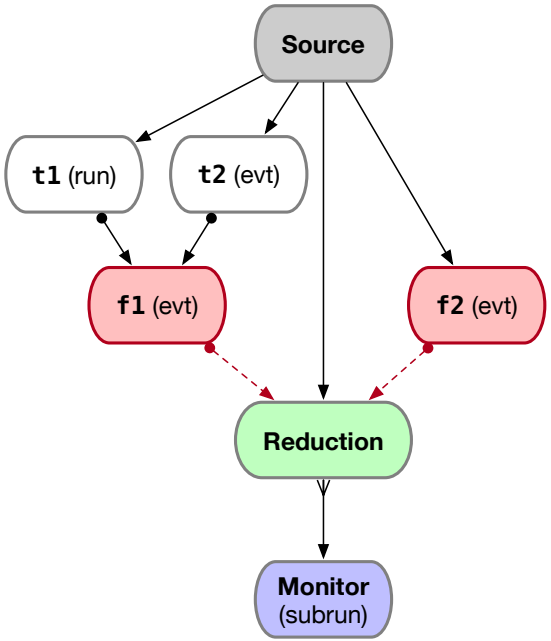


Configuration

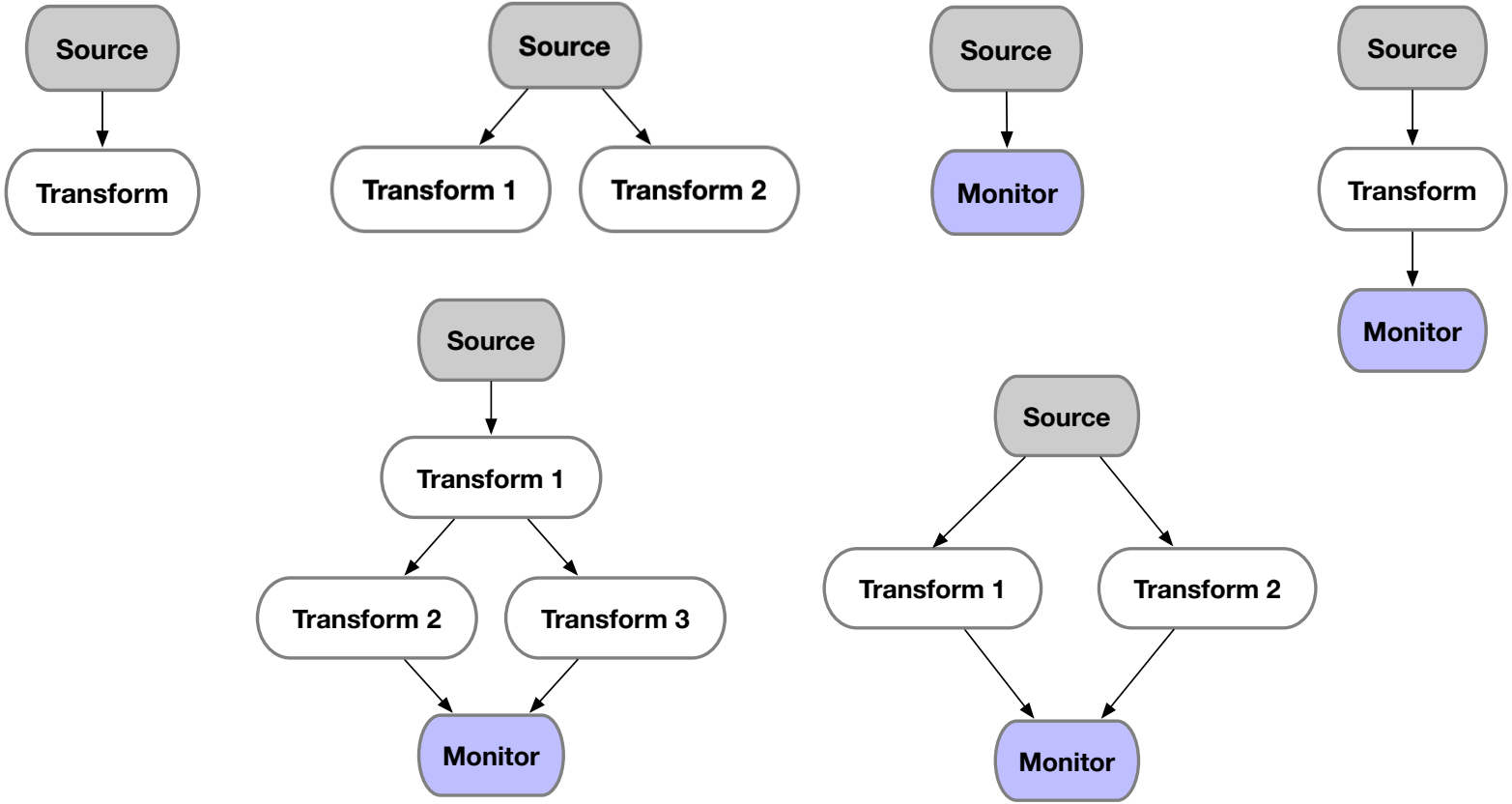
All modules (except sources) may specify preceding filters via configuration:




```
{
  source: { plugin: 'source_t' },
  modules: {
    t1: { plugin: 'transform_1' },
    t2: { plugin: 'transform_2' },
    f1: { plugin: 'filter_1' },
    f2: { plugin: 'filter_2' },
    reduction: {
      plugin: 'reduction',
      filtered_by: ['f1', 'f2'], # Logical AND of f1 and f2
    },
    monitor: { plugin: 'monitor' },
  },
}
```

Data product dependencies specified by glue code.

Benchmarks to test (transforms and monitors)



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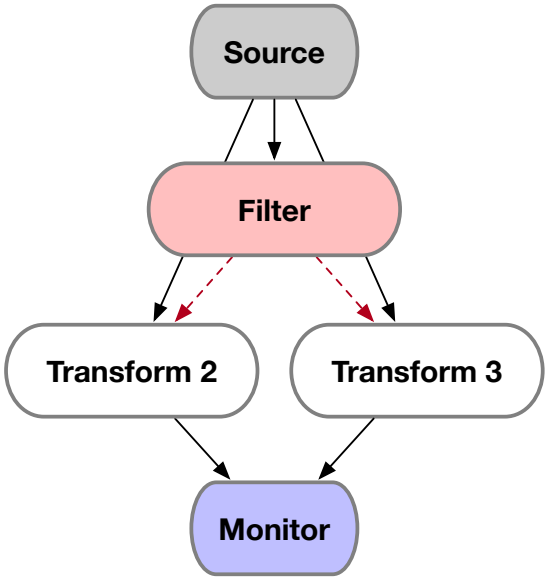
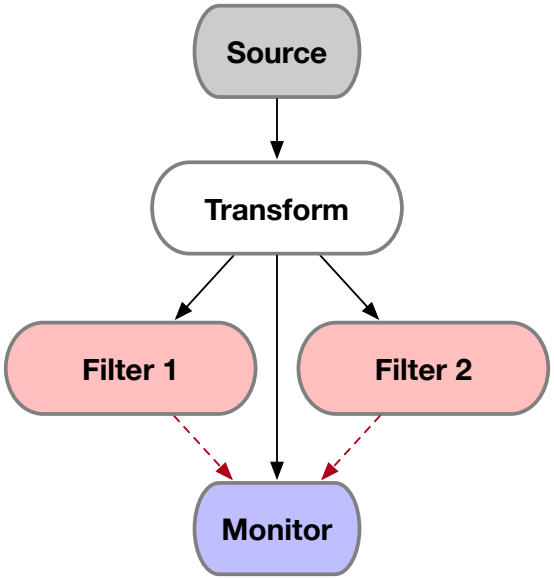
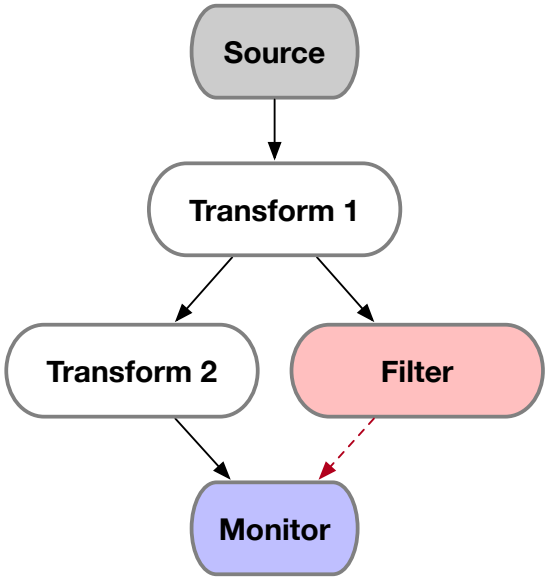
Benchmarks to test (filters)







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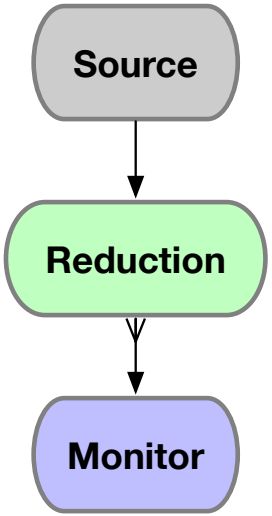
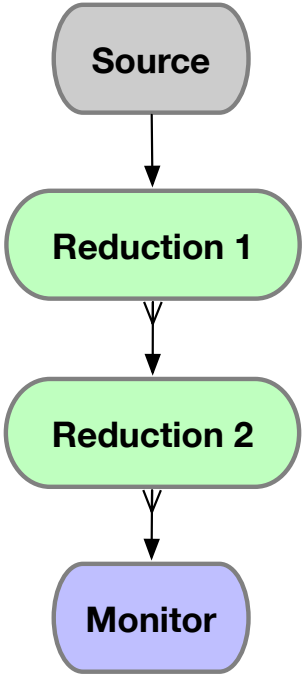
Benchmarks to test (reductions)

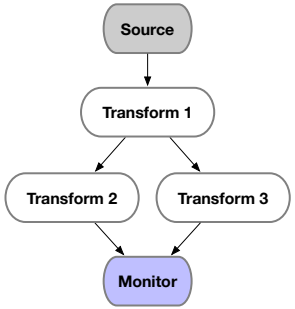




Next steps

- Run performance tests against *art* (started)

1M events



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TrigReport ---------- Event summary ------------
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TimeReport ---------- Time summary [sec] -------
TimeReport CPU = 342.198614 Real = 85.970735

MemReport  ---------- Memory summary [base-10 MB] ------
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Meld

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Preliminary

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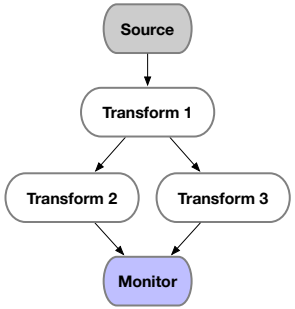

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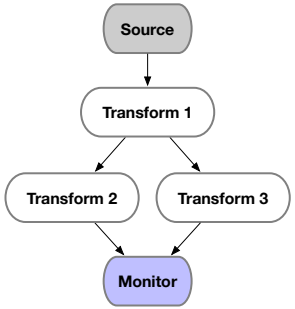

- Look at I/O
- Explore paths and backwards compatibility
- Thoughts?