

Design of a parallel software correlator

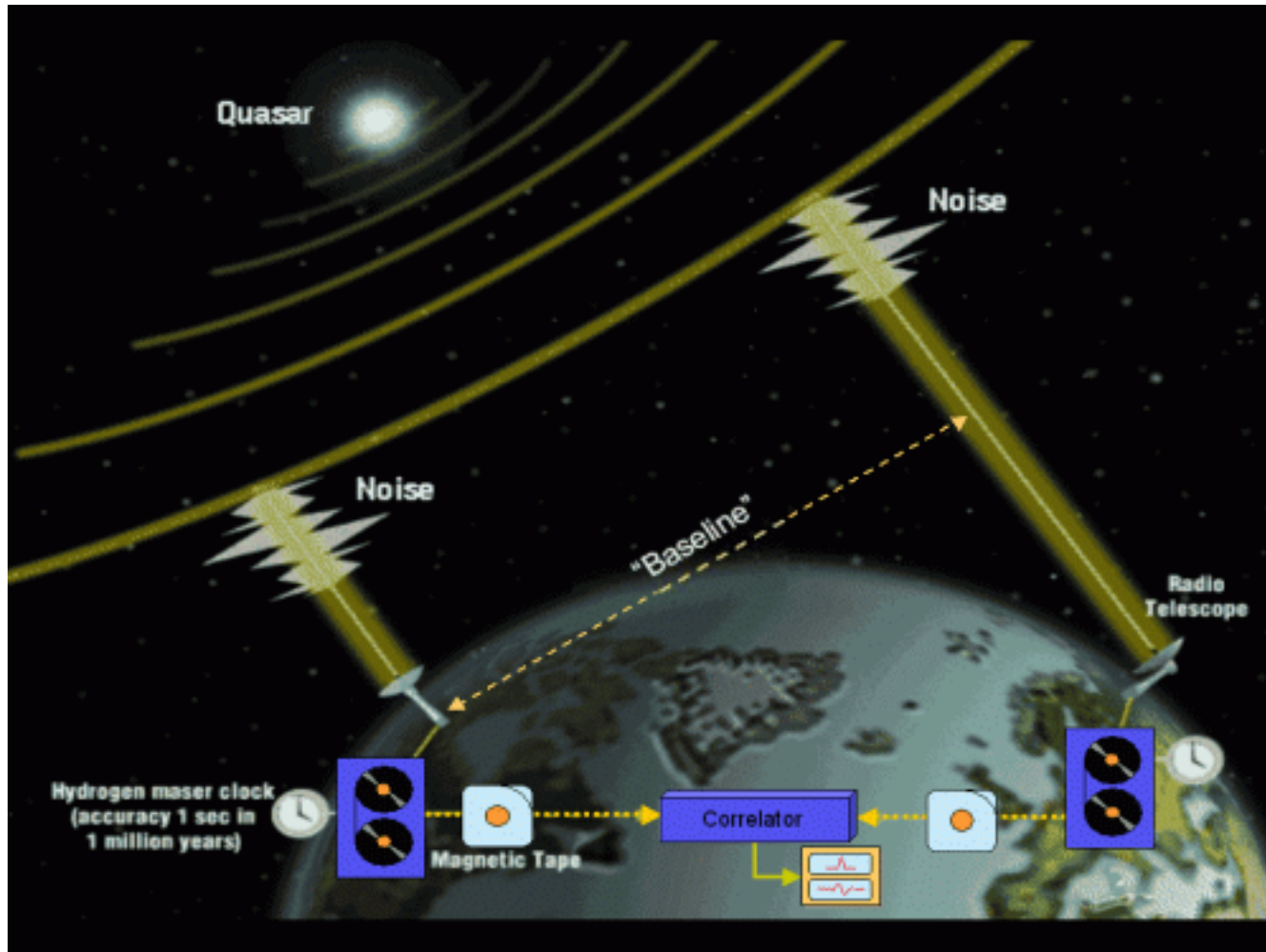
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VLBI

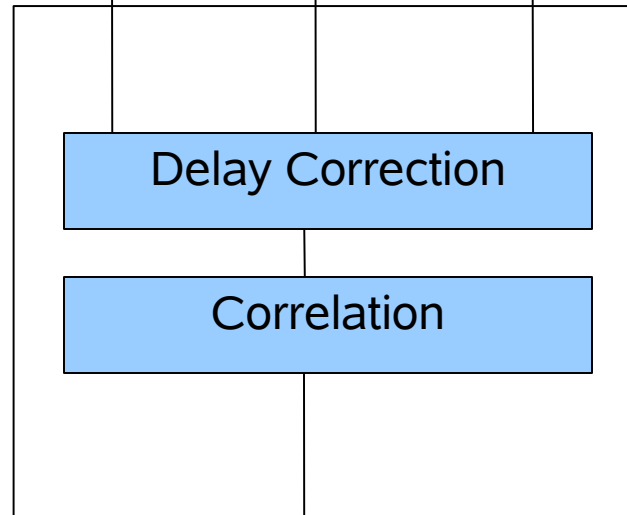


Software correlator

Telescopes



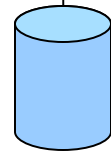
Software correlator



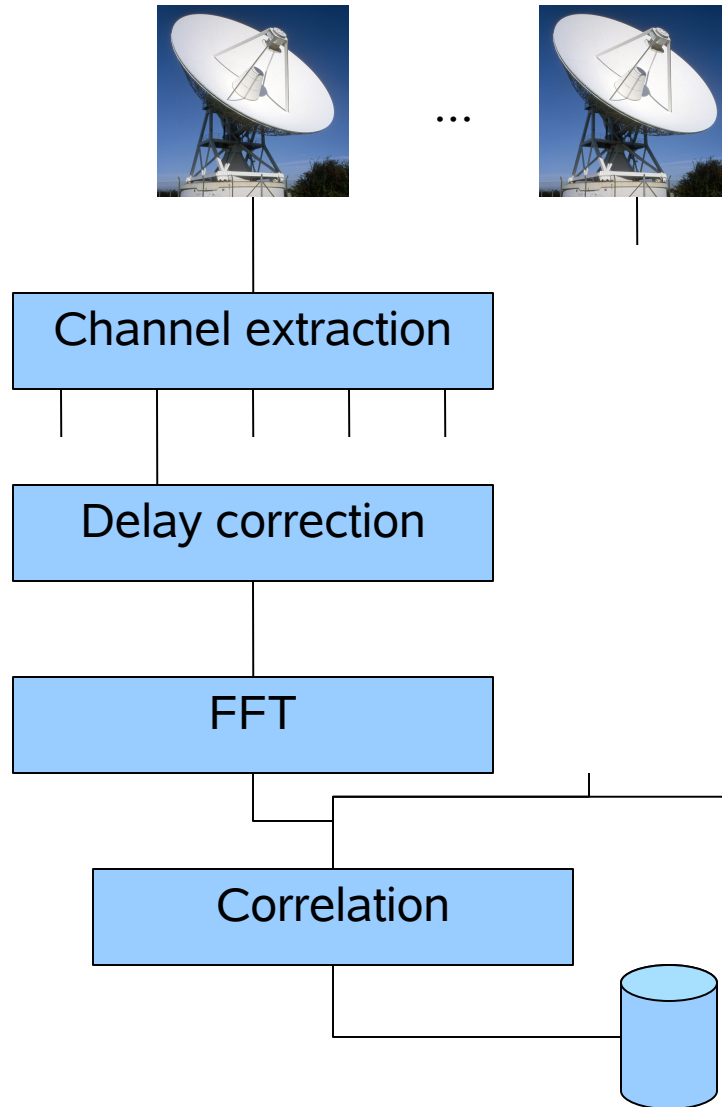
Linear

Quadratic

Output



Software correlator



Currently up to 1Gbs / telescope

Bit shifts

Tracks e.g. 64 / 128 Mbs

$12 + 10 \log N_f$, with N_f in [32, 1024]

1 float per 2 bits sample

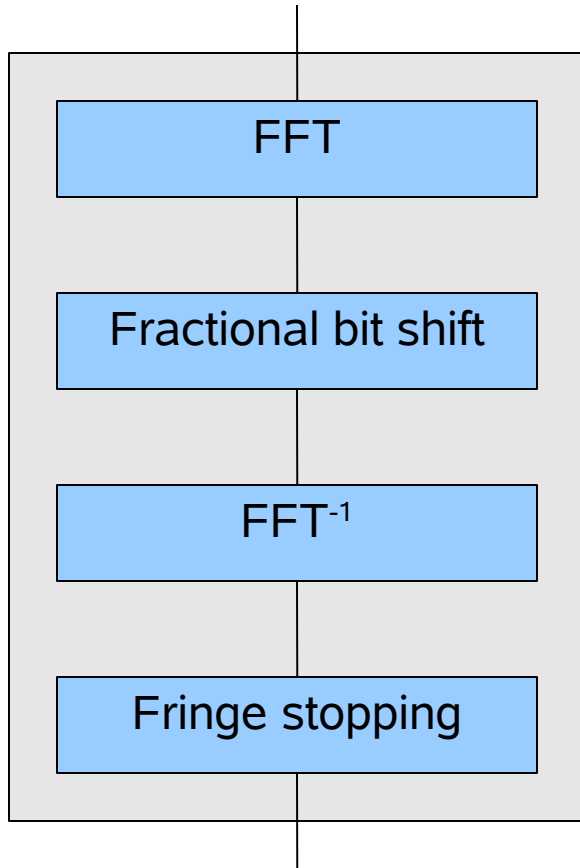
$5 \log N_f$, with N_f in [32, 1024]

Same data size

8 operations / baseline

Low data rate

Delay correction



Operations per 2 bits sample

$5 \log N_f \approx [25, 50]$ flops

6 flops, complex multiplication

$5 \log N_f \approx [25, 50]$ flops

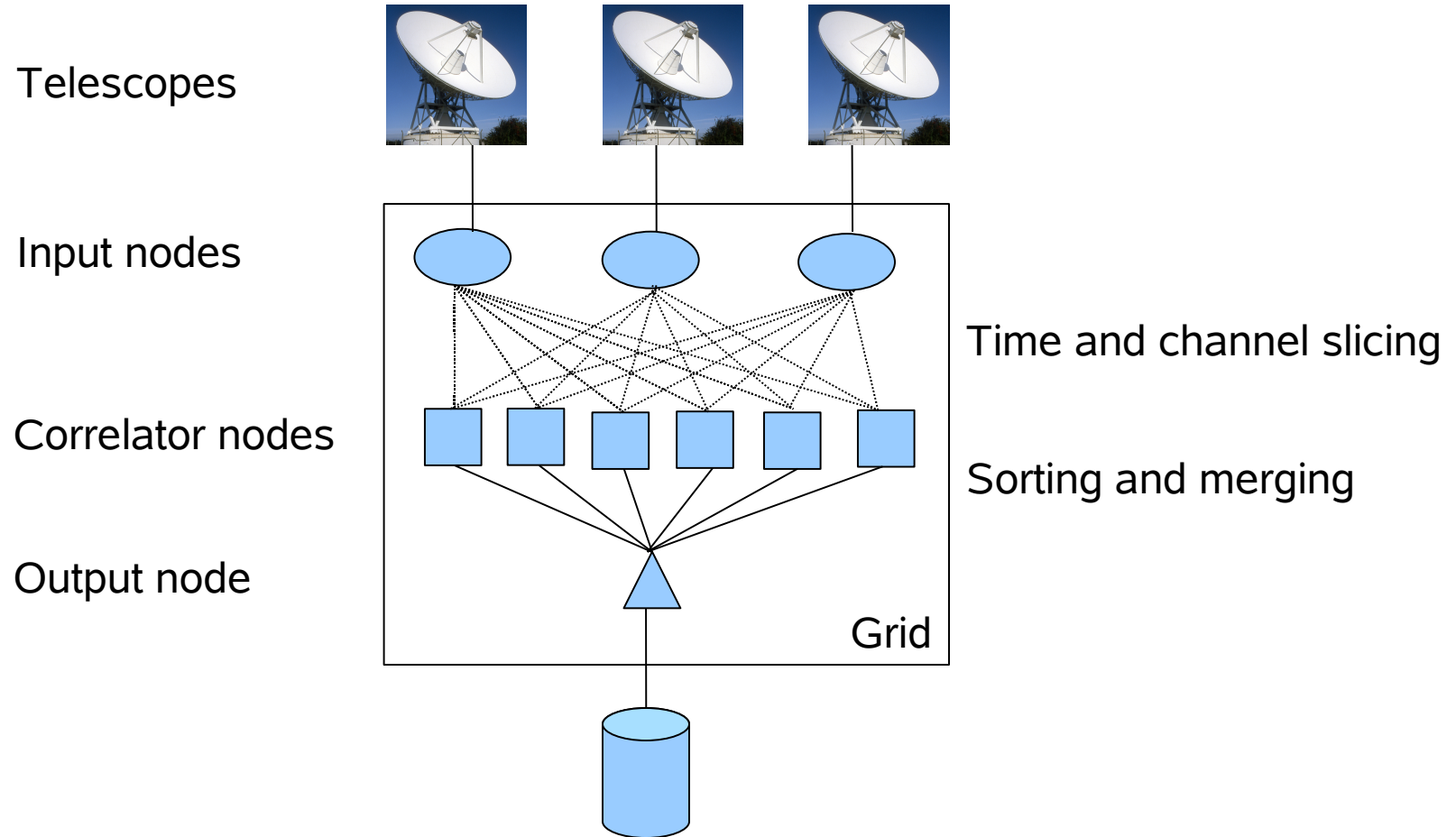
6 flops, complex multiplication

Total: $12 + 10 \log N_f \approx [62, 112]$ flops

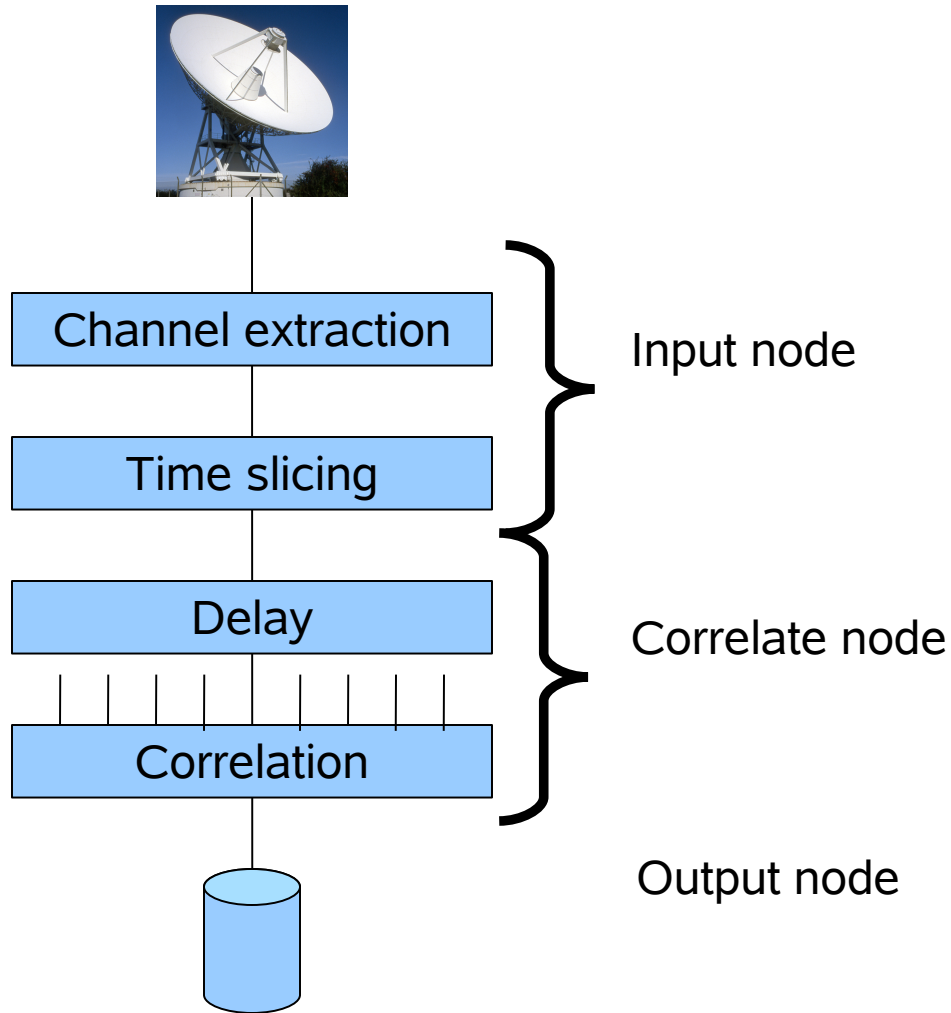
Some more numbers.

- Current JIVE correlator
 - 16 stations, 1Gb/s
 - 8 bands, 2 polarisations (4 pairs)
 - 32 spectral points (N_f)
 - Total: **1.8 Tflops**
- EVLA correlator:
 - 27 stations, 32 Gb/s
 - 4 bands, 2 polarisations (4 pairs),
 - 128 spectral points
 - Total: **244 Tflops**
- Break point of linear part and quadratic part
 - 1 polarisation: 20 telescopes
 - 2 polarisations: 5 telescopes

Software correlator on a cluster



Outline of the correlator



Design of a node

- Each node is a state machine
- Each node has
 - several controllers
 - a log writer
 - functionality for delegating MPI messages
- A controller can
 - Process MPI messages
- Examples of controllers are:
 - Handling input/output
 - Dedicated controllers for the node

Preliminary results

Running time

