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Data Processing Pipeline Concepts

Chris Young & Sandy Ballard

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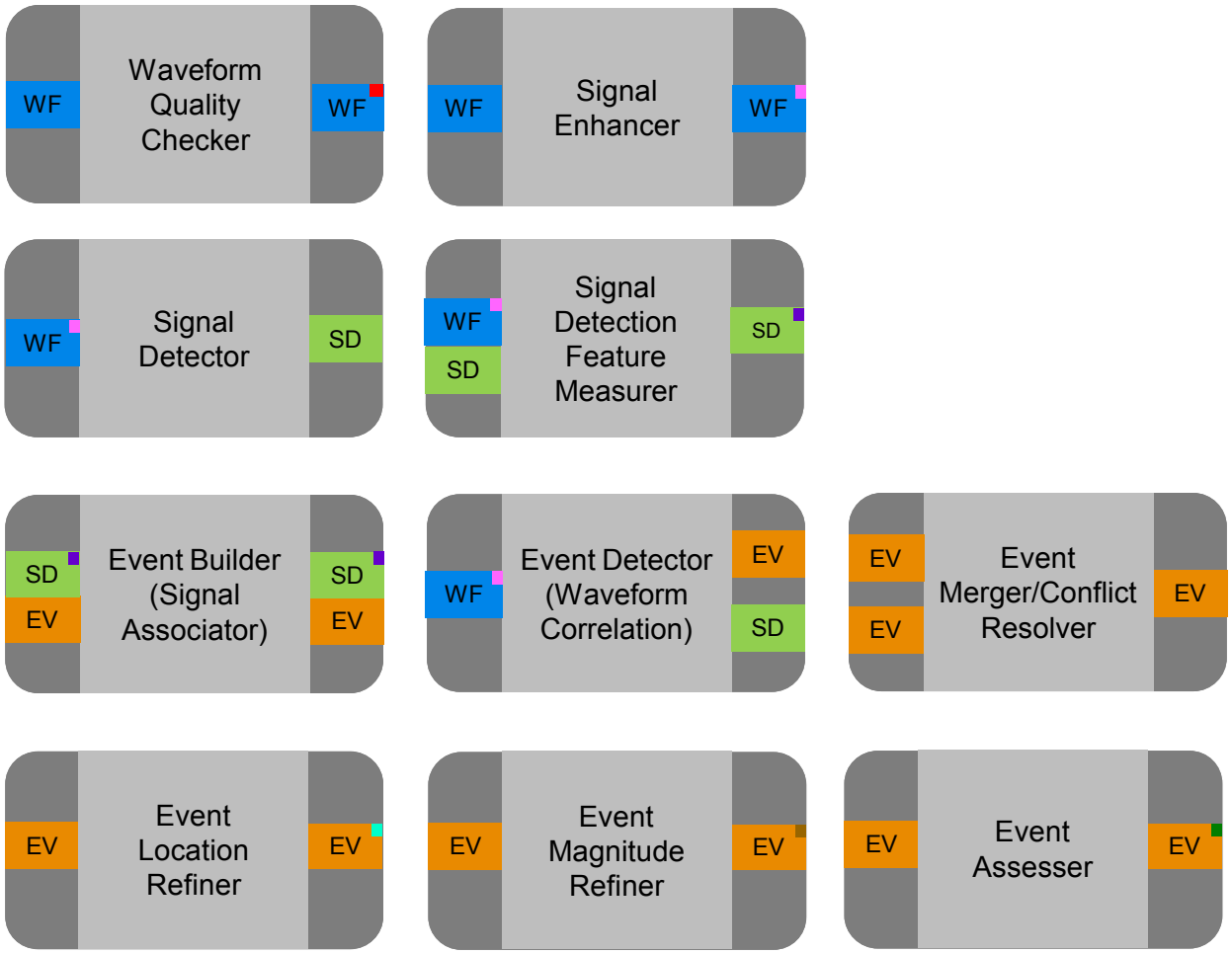
Data Processing Pipeline Building Blocks

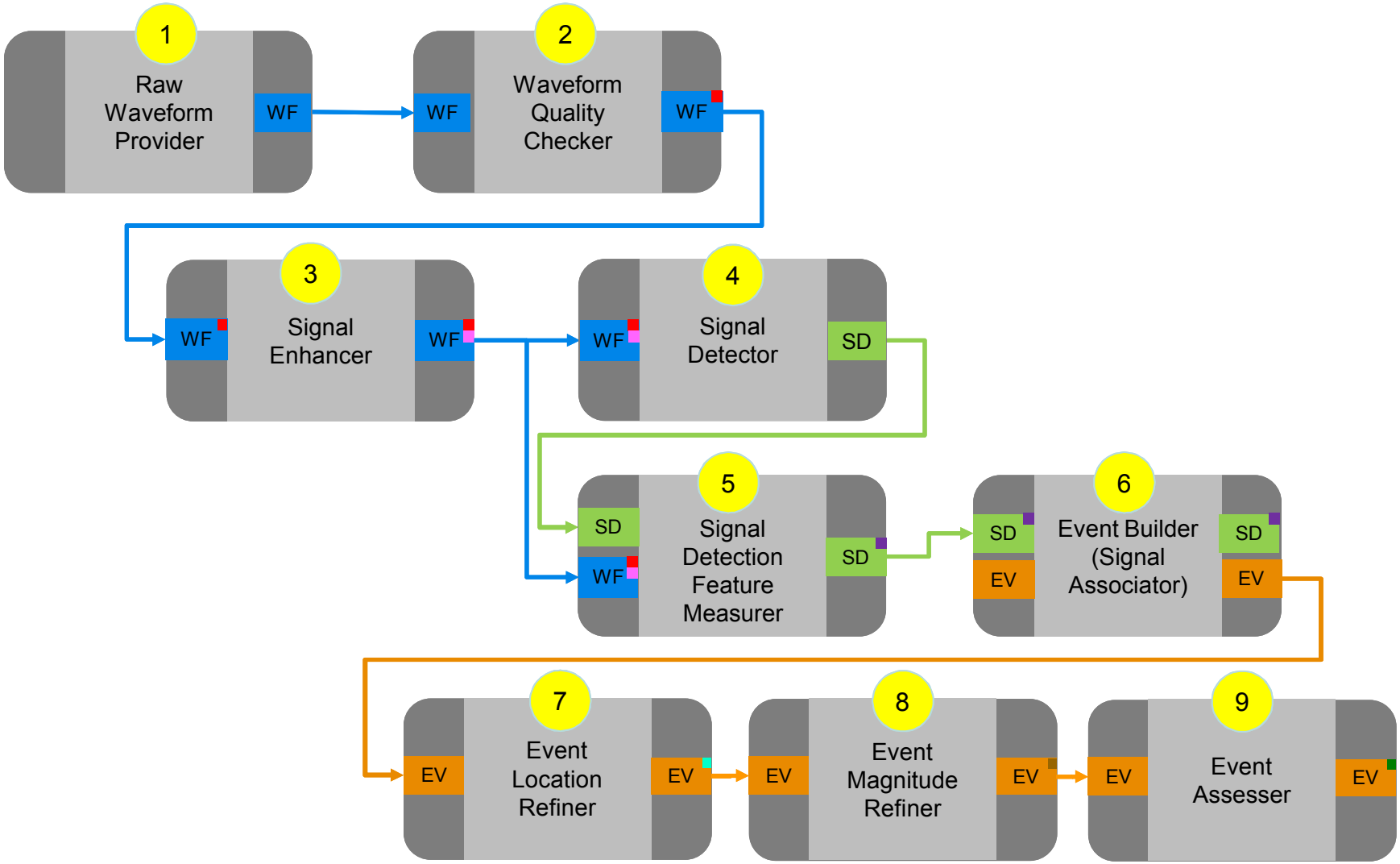
Input/Output

- WF — Waveform
- WF — Waveform with QC
- WF — Enhanced waveform
- SD — Signal detection (unassociated)
- SD — Signal detection with features
- EV — Event hypothesis w/associated signal detections
- EV — Event hypothesis w/expected signal detections
- EV — Event hypothesis w/refined location
- EV — Event hypothesis w/refined magnitude
- EV — Event hypothesis w/assessment
- EK — Empirical Knowledge. For historical events in a given area: most likely stations to detect, phases detected, filters applied, fk parameters, etc.

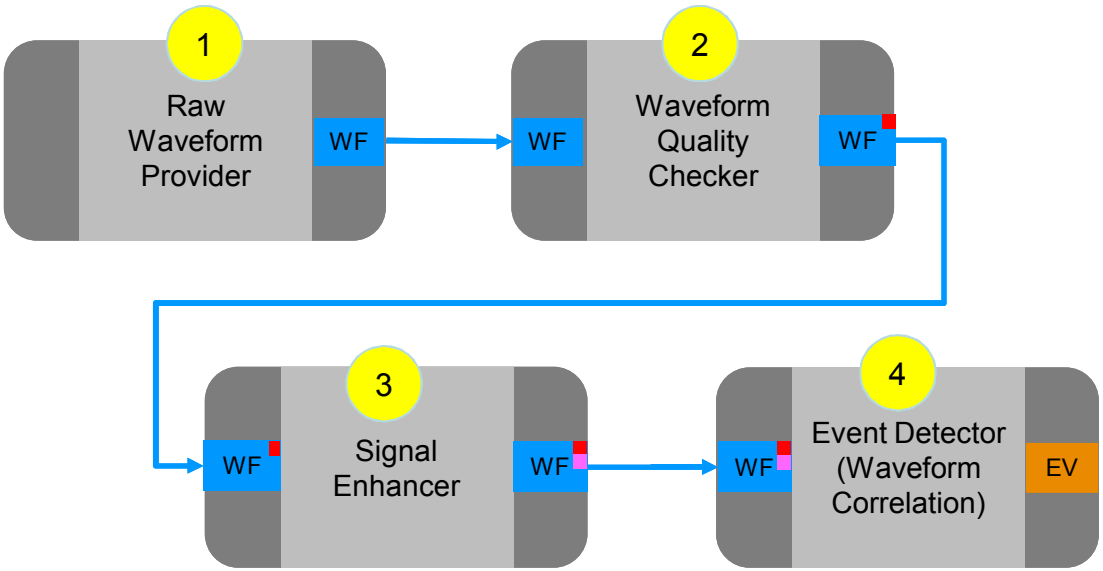
Data Processing Modules



Traditional Pipeline -- No Waveform Correlation

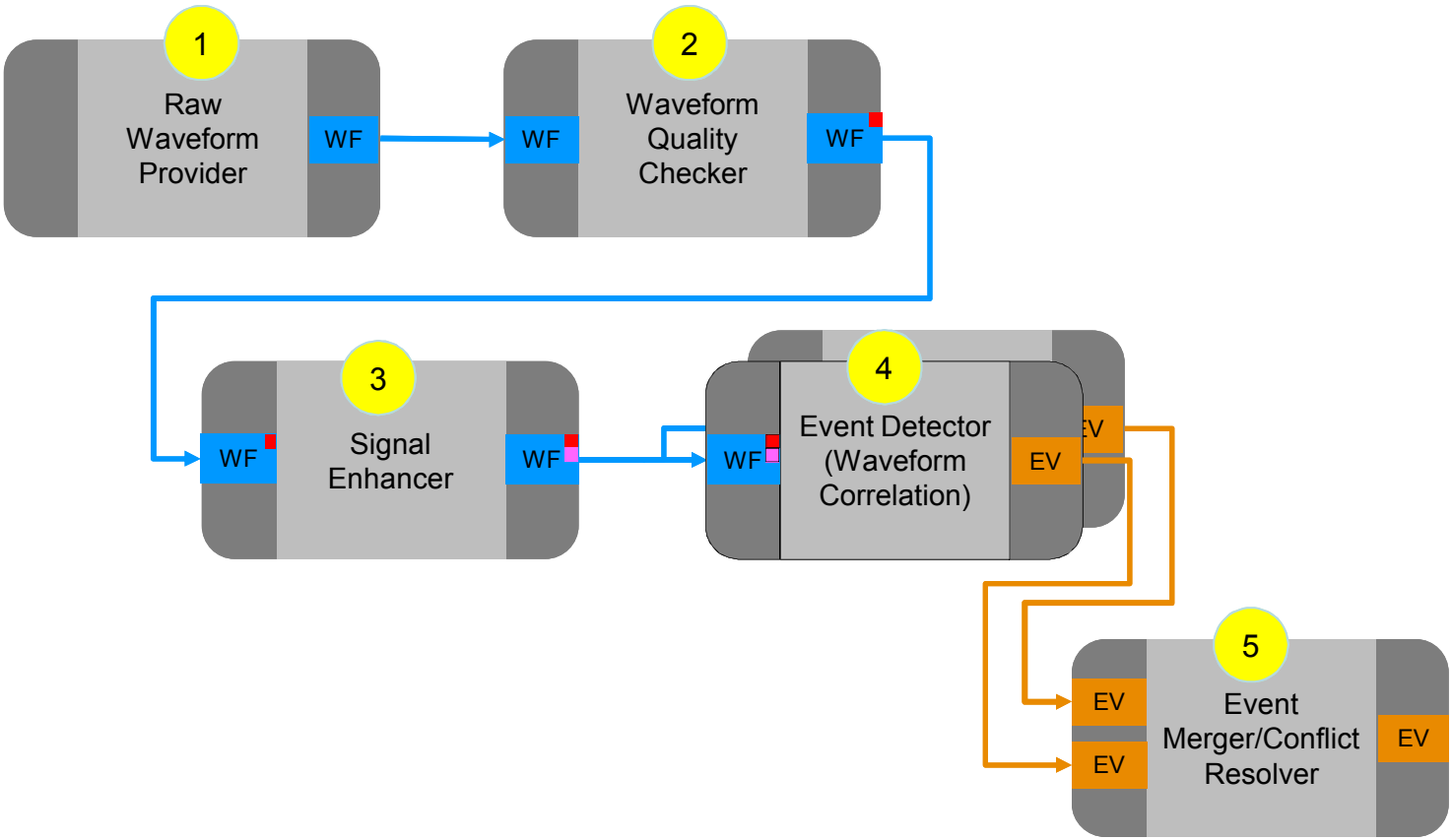


Simple Waveform Correlation Event Detection (Single Station)



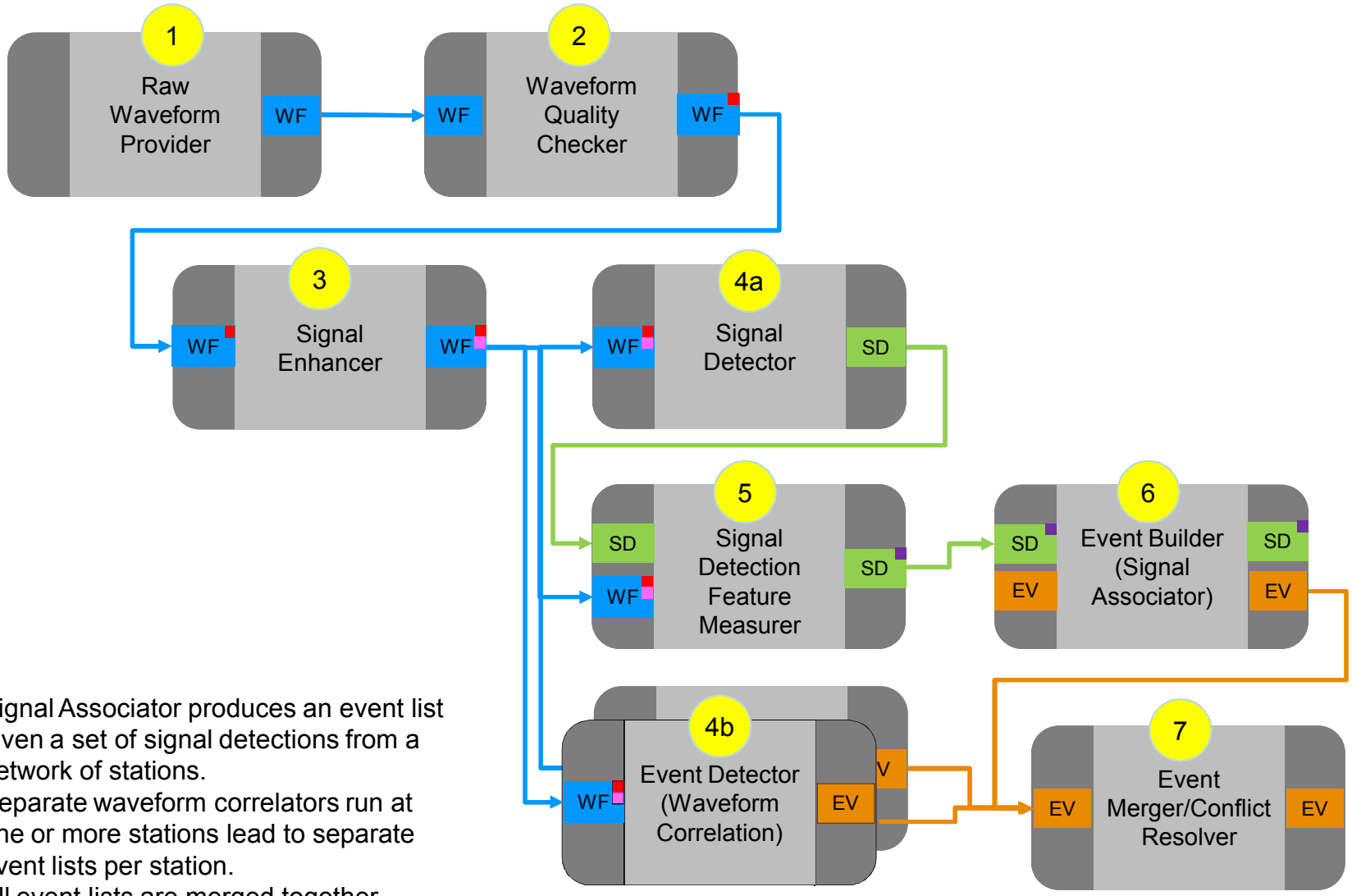
- Separate correlators run at one or more stations lead to separate event lists per station
- No merging of event lists

Waveform Correlation Event Detection with Multi-Station Event Merging



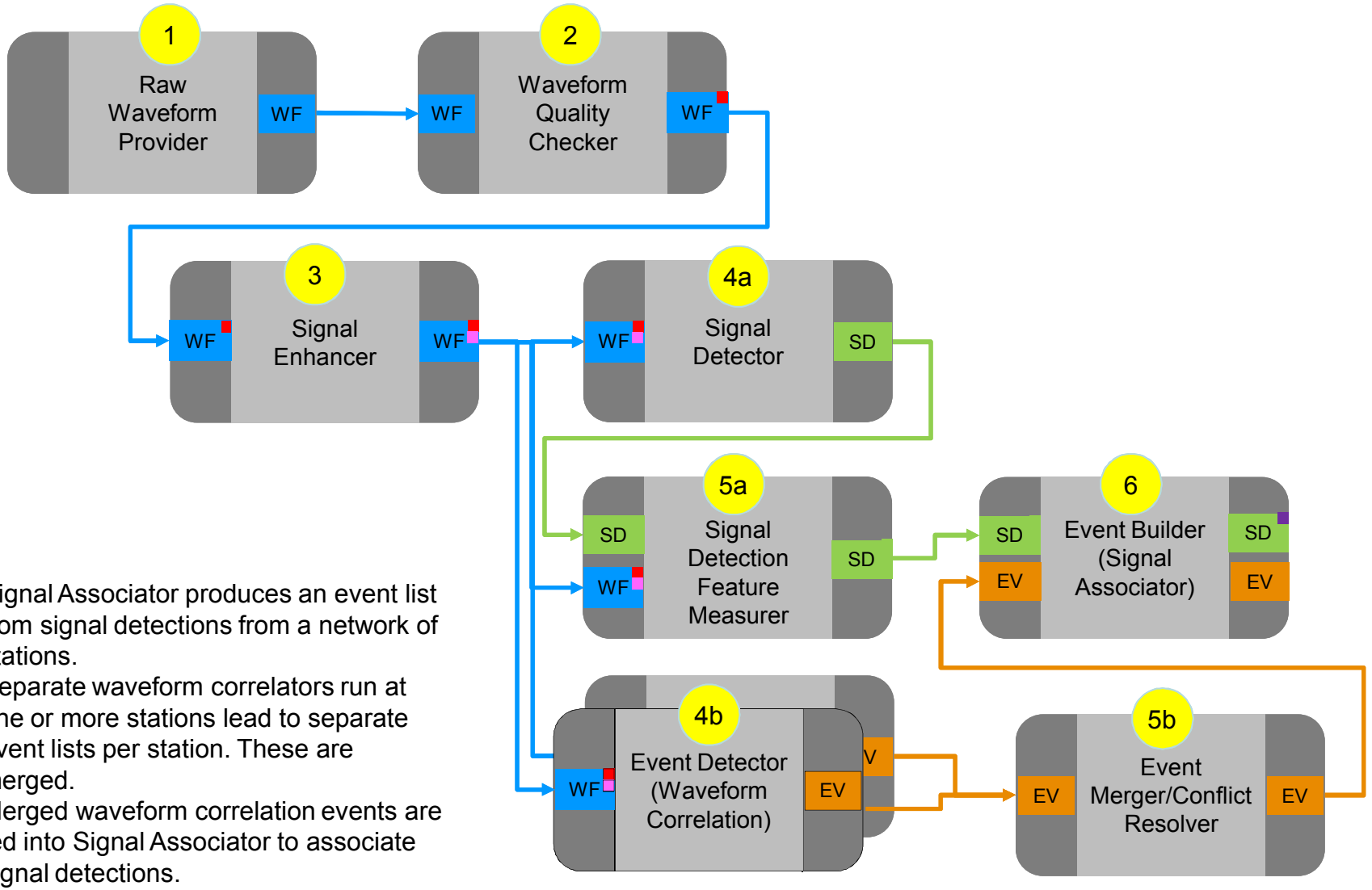
- Separate correlators run at one or more stations lead to separate event lists per station
- Separate event lists are merged into one

Traditional Pipeline Plus Waveform Correlation Event Detection: Option 1



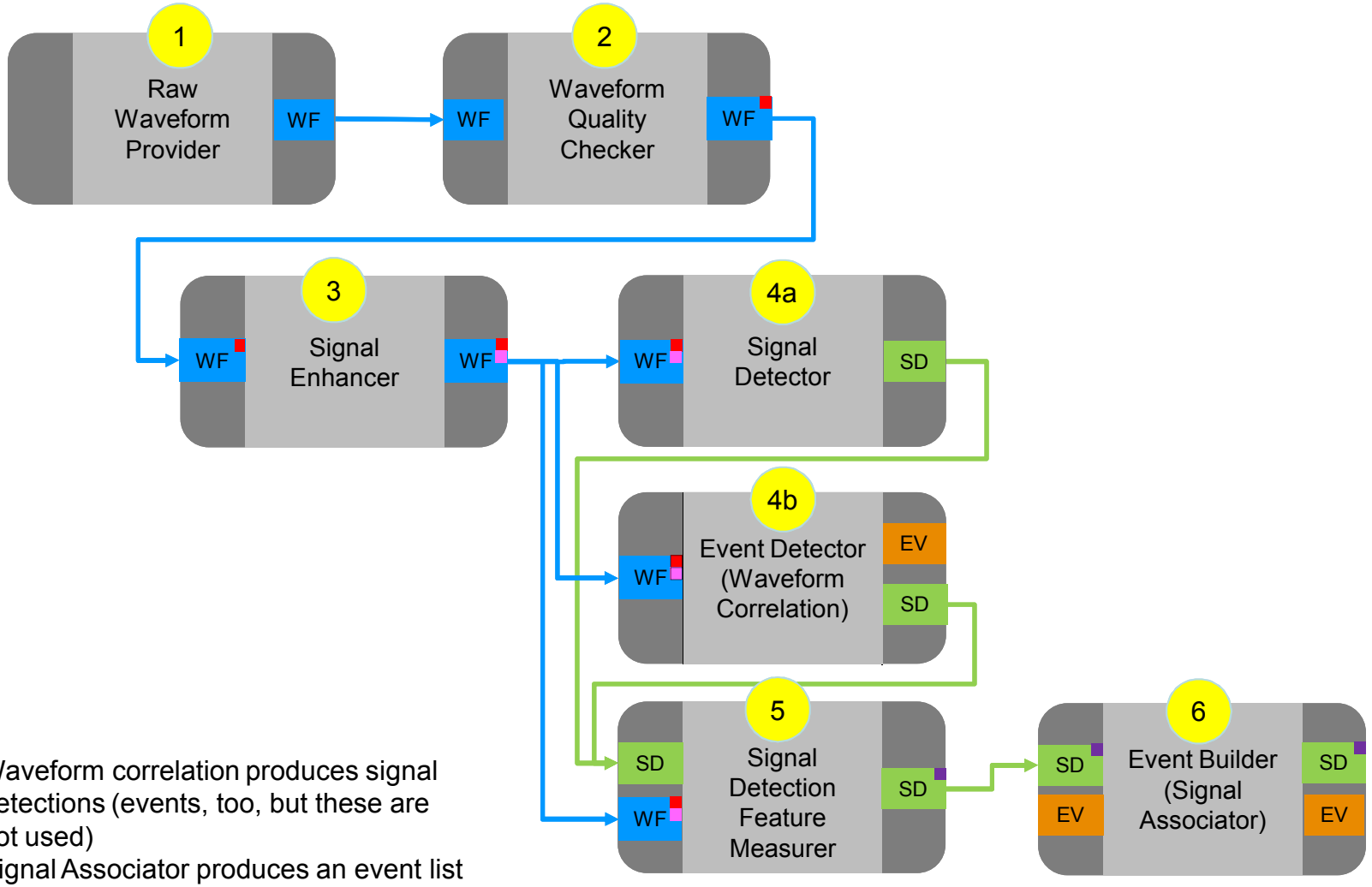
- Signal Associator produces an event list given a set of signal detections from a network of stations.
- Separate waveform correlators run at one or more stations lead to separate event lists per station.
- All event lists are merged together.

Traditional Pipeline Plus Waveform Correlation Event Detection: Option 2



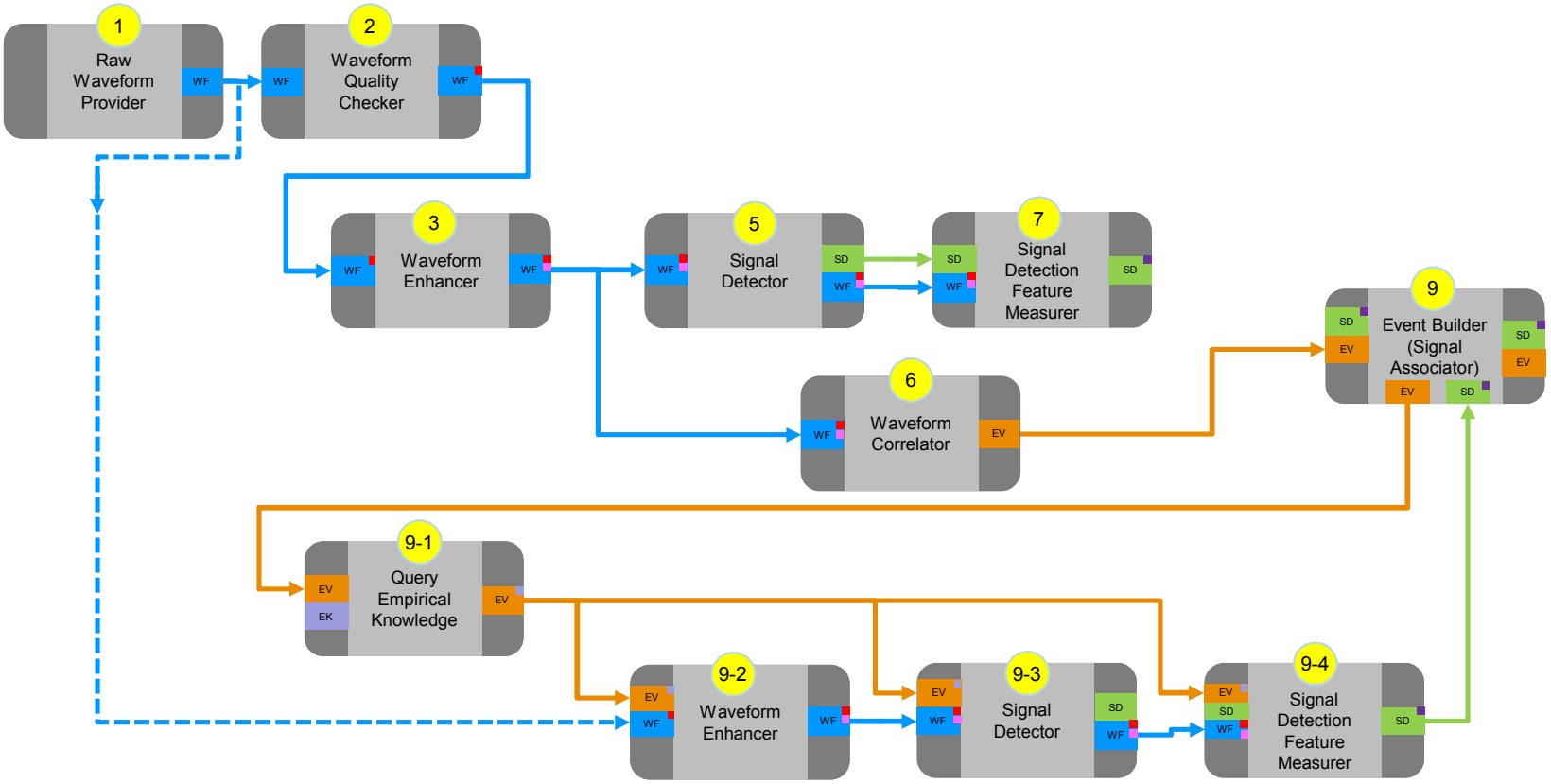
- Signal Associator produces an event list from signal detections from a network of stations.
- Separate waveform correlators run at one or more stations lead to separate event lists per station. These are merged.
- Merged waveform correlation events are fed into Signal Associator to associate signal detections.

Traditional Pipeline Plus Waveform Correlation Signal Detection



- Waveform correlation produces signal detections (events, too, but these are not used)
- Signal Associator produces an event list from *all* signal detections from a network of stations.

Enhanced Pipeline – *models the way humans work*



- While processing a time block, Event Builder can invoke processing modules in order to verify/improve an event it is working on:
  1) try to detect signals that are missing but likely by invoking Waveform Enhancer and/or Signal Detector with different parameters,
  2) re-calculate measurements that are not what is expected (e.g. a bad azimuth) by invoking Signal Feature Measurer with different parameters.
- Events passed from Event Builder to these sub-processes first go to Query Empirical Knowledge to gather information about *expected signals* based on event location.
- Event Builder is iterative, processing until stability is reached (no new events can be built, no signal associations change, no missing signals to look for, no measurements left to refine).