Flows

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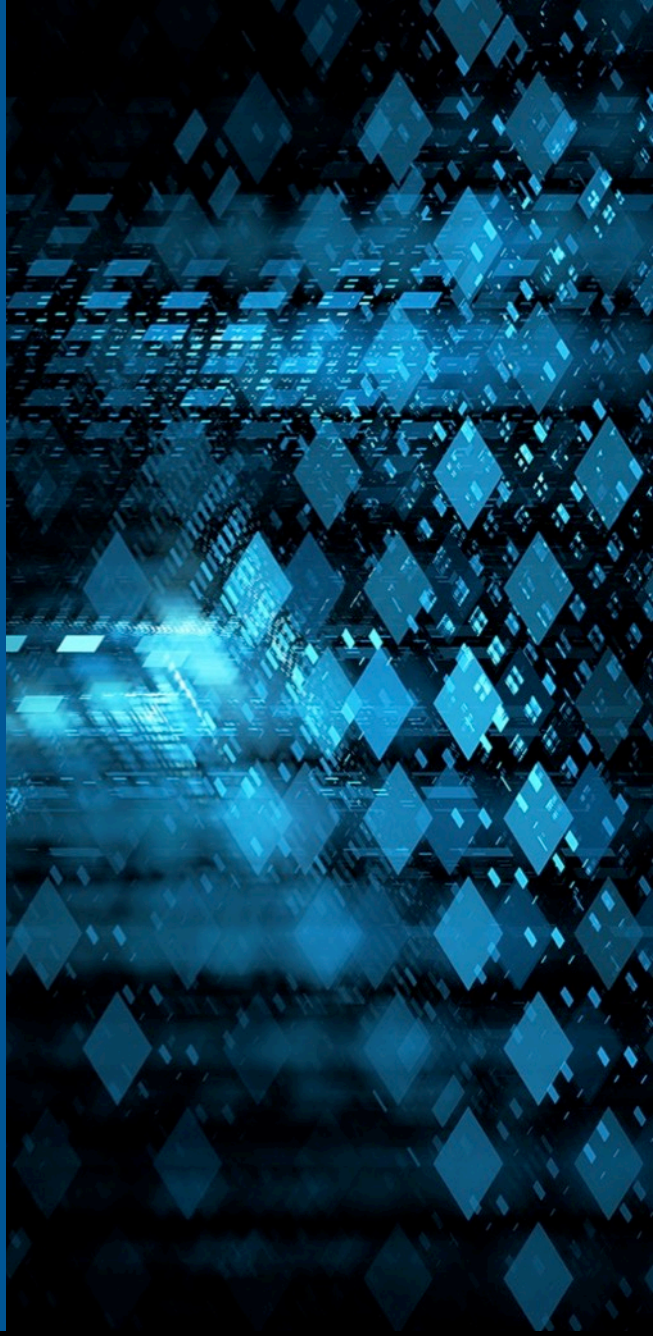

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Flow Specifications and Sequences

Flow specification

- Flow source, sink, path
- For features and element in named interface features

Flow implementation

- Assignment of flow sequence to flow specification

```
interface control is
insignal: in port;
outaction: out port;
processflow: flow path insignal -> outaction;
end;

process control.impl is
    dofilter: thread filter;
    docompute: thread compute;
    extin: mapping insignal => dofilter.insignal;
    ftoc: connection dofilter.outsignal -> docompute.insignal;
    extout: mapping outaction => docompute.outsignal ;
    processflow => flow dofilter.filterpath -> ftoc -> docompute.computepath ;
end;
```

End to end flow sequence

```
controltoactuate: connection processing.outaction -> actuate.inp;
etef: end to end flow sense.reading -> sensetocontrol-> processing.processflow -> controltoactuate -> actuate.action;
```

Flow Sequence Specification

Currently (V2)

- Alternating component.flowspec and connection
- Alternating component and connection
  - Flow spec inferred from connection end points
  - Flow related property inferred from value assigned to component

Additional flexibility

- Component.flowspec sequence only
  - Infer connections
- Connection sequence only
  - Infer component and flow spec
- Reach down for components without flow spec
  - E.g., nested subcomponents
- End to end flow starting and endpoint
  - Define flow path with end points
  - Assign flow sequence as we do for flow spec

Flows at Platform Level

- Flow sequence as target of connection binding

Flow Graphs

Objective: Forward and backward traceability

- Forward: variation in latency/age at all end points
- Backward: variation in latency/age from all contributing sources
- Auto-generate from flow specs and connections
  - As we do for propagation graphs

Fan-in/out logic for each component (Merge point semantics)

- Fan in across ports
  - Flow path with multiple inputs (AND)
  - Separate flow paths as alternatives (OR)
  - Pre and post conditions on input/output
- Interpretation of BA logic
  - Input on several ports triggers dispatch
  - Fan in at single port with multiple incoming connections
- Fan out to multiple ports
  - All vs. alternative (Not needed) The fan-in takes care of everything. John Hatcliff discussion on canonical)

Flow Patterns

- End to end flow spec (endpoints only)
  - Etef1: **flow** sys.proc.thread1.fsrc -> * -> sys.proc2.thread4.snk
  - Endpoint spec as reference down the hierarchy
  - Infer all possible paths
  - Etef2: **flow all**(GPS.fsrc) -> * -> **all**(Displays.view)
  - Infer all instances, i.e., all paths between any GPS and DIsplay
- Flow impact
  - Impact : **flow** sys.gps.signalsrc -> *
  - **All(**FlowSpec) -> *
- Flow contributors
  - Effector : **flow** * -> sys.actuator.cmd
  - Effector : **flow** * -> sys.actuator.cmd