Hierarchical Flow Aggregation – Problems and Open Questions

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Outline

- Problem Statement
- Mediation Processes
- Hierarchical Aggregation
- Problems
Problem Statement

- Two Mediation Processes:
  - Receive Flows
  - Select Flows (Filtering)
  - Create Flows (Aggregation)
  - Export Flows
## Problem Statement

<table>
<thead>
<tr>
<th>Two Mediation Processes:</th>
<th>Existing Processes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receive Flows</td>
<td>Receive packets</td>
</tr>
<tr>
<td>Select Flows (Filtering)</td>
<td>Select packets (Sampling)</td>
</tr>
<tr>
<td>Create Flows (Aggregation)</td>
<td>Create Flows (Metering)</td>
</tr>
<tr>
<td>Export Flows</td>
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Flow Aggregation

Define desired Flow Keys of Compound Flows

- Defines Template to be used for export
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For each two incoming Flows:
- Examine these Key fields’ values
- If fields have equal values: merge Flows
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Merging Flows:
- Flow Key fields’ values are identical; copy values
- Non-Key fields’ values differ; merge values
  - For counters, use sum
  - For ranges, use extrema
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Flow Filtering

For each incoming Flow:

- Compare Flow’s fields with series of filtering criteria
- Accept if all fields have equal values (logical AND)
- Identical to PSAMP "match" algorithm
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Additional Filters desirable:
- Check non-equality of fields values (logical NOT)
- Accept based on list of possible values (logical OR)
- Accept based on range of possible values
What to do first – filtering or aggregation?

- Both options make sense:
  - Aggregating filtered flows
  - Filtering aggregated flows
- Even more options in hierarchical deployment:
  - Filter, aggregate, (export, collect,) aggregate, filter
Architectural Considerations

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Need flexible way of configuring process order

- Best order of processing steps varies widely
Flow Processing Example

In:
1x UDP 1.2.3.4:80 > 1.2.3.5:1080
1x UDP 1.2.3.4:80 > 1.2.3.5:1080
1x TCP 1.2.3.4:80 > 1.2.3.5:1080
1x UDP 2.3.4.5:80 > 2.3.4.6:1080

Out:
3x 1.2.3.4:80 > 1.2.3.5:1080
Communicating Flow Treatment

How PSAMP communicates selection criteria:

- Track which Selectors a packet has passed
- Assign identifier to this Selection Sequence
- Annotate created Flow with this identifier
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Use this for communicating Flow treatment?
- Track which Filters and Aggregators a Flow passed
- Assign identifier to this sequence of processes
- Annotate Compound Flow with this identifier
Problems

Need to include information about multiple branches

- When merging Flows from multiple Filters:
- Flows can pass either one to be merged
- Just refer to all contributing processes’ IDs?
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Should later Filters be able to consider earlier Filters’ criteria?

- e.g. filter for "TCP or UDP" and discard the protocol;
  Can one still expect this to match Filter "not ICMP"?
- Filters then need to interpret configuration of earlier ones
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How to configure these Mediators?
- Structure is no longer a tree...
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Thanks!

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