ForCES Packet Parallelization

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Problem Drivers

- Actual hardware can sometimes perform multiple actions in parallel
- There is currently no way for a CE to tell an FE when and how it can make use of this capability
  - A really smart FE could guess, but…
- We therefore propose two new LFB classes to allow the CE to manipulate parallelism
  - Many devices will not support these. Some will.
Packet Parallelization Types

- **Flood**
  - Copies of a packet is sent to multiple LFBs

- **Split**
  - A packet is split into multiple equal size chunks\(^1\) (CE-specified) and sent to multiple LFBs.

\(^1\)Except the last one
Introduced LFBs

- **Splitter**
  - Splits the path of a packet and sends to multiple LFBs.
  - 1 singleton input port.
  - 1 group output port.

- **Merger**
  - Receives packets or chunks and merge them into 1.
  - 1 group input port.
  - 1 singleton output port.
Idea status

- This needs more work ad review
- This is currently not within the WG chart
  - But is a natural fit for this WG
- We suggest this be included as a work item in the new charter for the WG.
Use cases

**Split Type:**
- Splitter LFB
- Regex LFB
- Regex LFB
- Regex LFB
- Merger LFB

**Flood Type:**
- Splitter LFB
- Classifier LFB
- Meter LFB
- IPv4 Decrement TTL LFB
- Merger LFB
Use cases – complex

Splitter LFB

LFB

Merger LFB

Splitter LFB

LFB

LFB

Splitter LFB

LFB

LFB

Merger LFB

LFB

LFB
Split/Merge metadata

- Splitting/Merging are implementation issues – Document specifies operational parameters to control splitting/merging.

- Metadata created by splitter LFB to be received by Merger LFB – Opaque to LFBs in parallel paths:
  - ParallelType – Specifies flood or split.
  - Correlator – Identify packets or chunks belonging to the same original packet.
  - ParallelNum – Packet/Chunk number.
  - ParallelPartsCount – Total Number of Packets/Chunks.
Parallel Path mechanics

- In case of another splitter/merger in the path, the merge metadata MUST be tunneled through.
- A chunk/packet MAY be dropped in the path but the merge metadata MUST reach the Merger LFB. (opposite text remained by error in draft – will fix)
- Metadata produced in parallel paths MAY be aggregated with the merger LFB and sent on.
- In case of same metadata produced with different values, the first received MUST be kept.
Backup – 1: Splitter LFB

**Components**
- ParallelType (uchar)
- ChunkSize (uint32)

**Capabilities**
- MinMaxChunkSize
  - struct of `{min(uint32), max(uint32)}`

**Events**
- ParallelOut

Input ————> Splitter LFB ————> ParallelOut

- Packet / Chunk Metadata
- Packet / Chunk Metadata
- Packet / Chunk Metadata
Packet is received.

- **ParallelType == 0**
  - Copies of packet is sent through parallel out through all output instances along with metadata.

- **ParallelType == 1**
  - Packet is split into chunks of size==ChunkSize and each chunk is sent through one of instance of output instance’s in a round-robin fashion.
  - Last chunk size’s may be size<ChunkSize.
Backup – 3: Merger LFB

**Components**
- InvalidAction (uchar)
- MergeWaitType (boolean)
- InvalidMergesCounter (uint32)
- InvalidIDCounters (struct of:
  - InvalidExceptionID(Array of {uint32})
  - InvalidValidateErrorID (Array of {uint32})
  - InvalideMetadataSets(Array of {String}))

**Capabilities**

**Events**
- ManyInvalids (InvalidMergesCounter >)
- ManyAllInvalids (InvalidAllCounter >)
Backup – 4: Merger LFB (2)

- Receives packet/chunk via group input ParallelIn along with merging metadata.
- If packet/chunk was invalid it MUST receive the merging metadata and MAY receive an ExceptionID or ValidateErrorID and MAY receive the packet/chunk as well.
- If MergeWaitType==false the Merger LFB will start merging upon receiving the first packet/chunk.
- If Invalid Action==0 it drops all packet/chunk. If 1 it will continue with the merge.
The merger LFB for statistics keep counters for the following:

- InvalidMergesCounter – Merges with at least one Invalid
- InvalidAllCounter – Merges with all invalid.
- InvalidMetadataSets (optional) – Stores metadata sets along with the error id as a string.

Includes two events:

- InvalidMergesCounter greater than value.
- InvalidAllCounter greater than value.