BIER(-TE) & DetNet

IETF101

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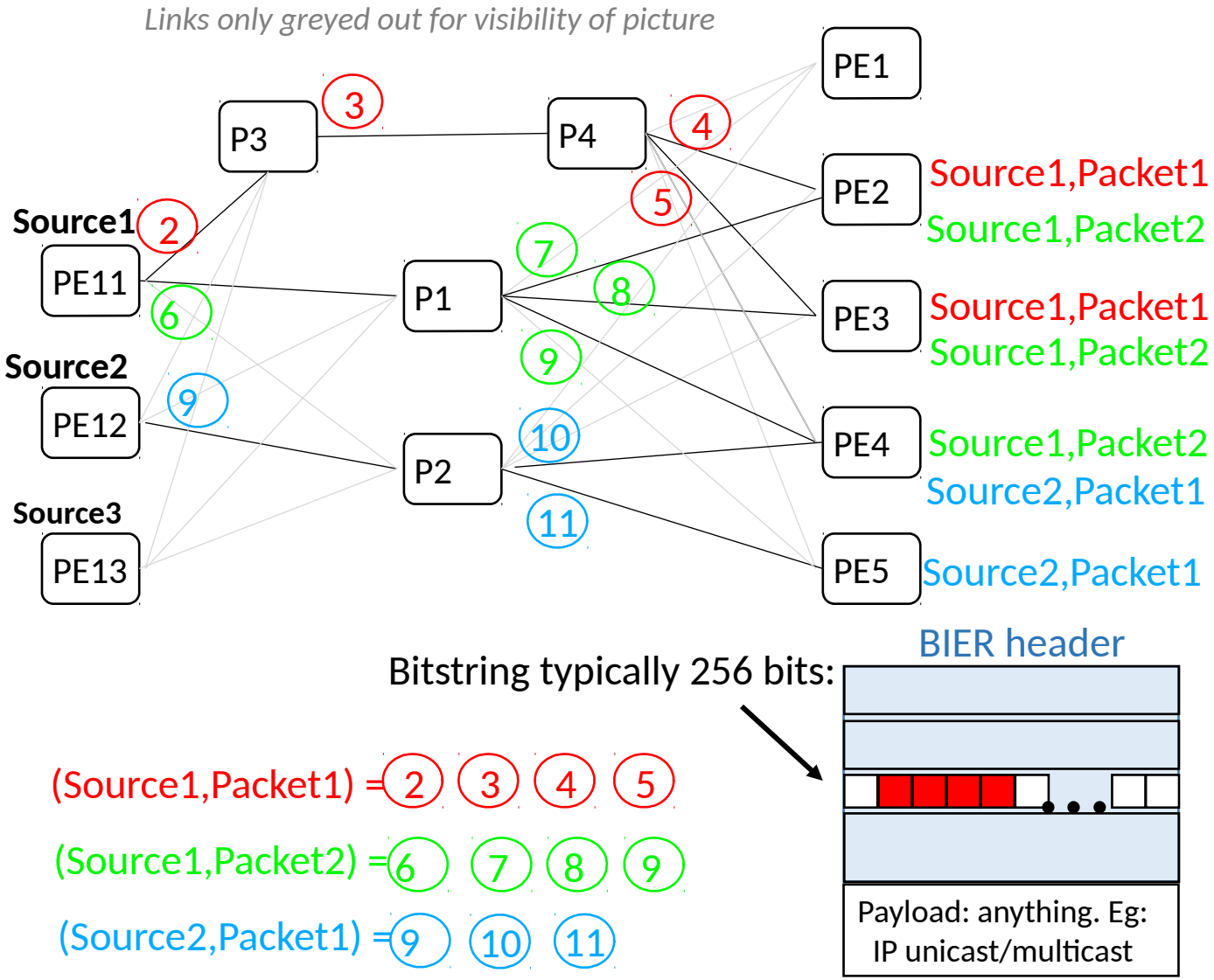
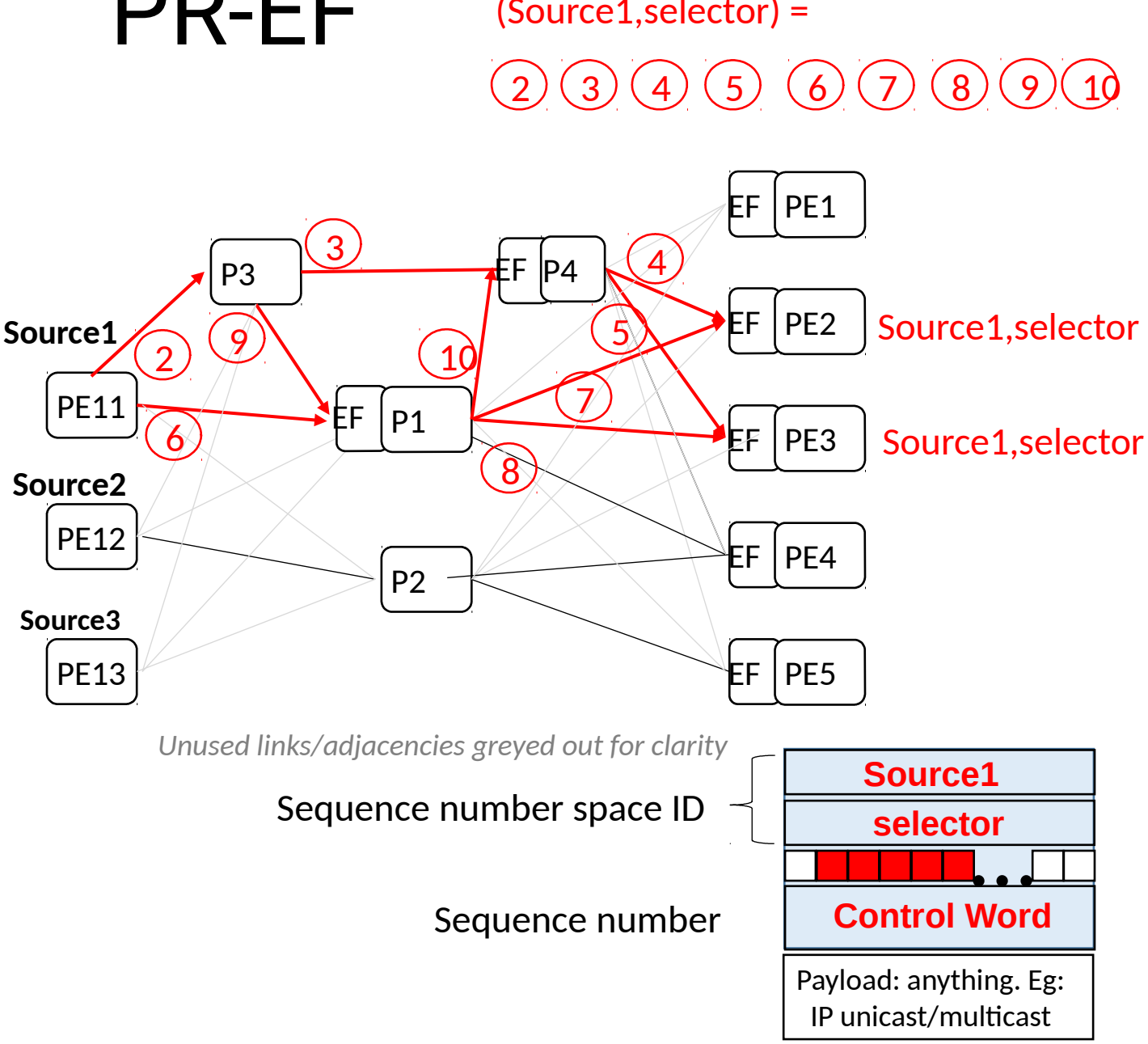
BIER with traffic engineering (1)



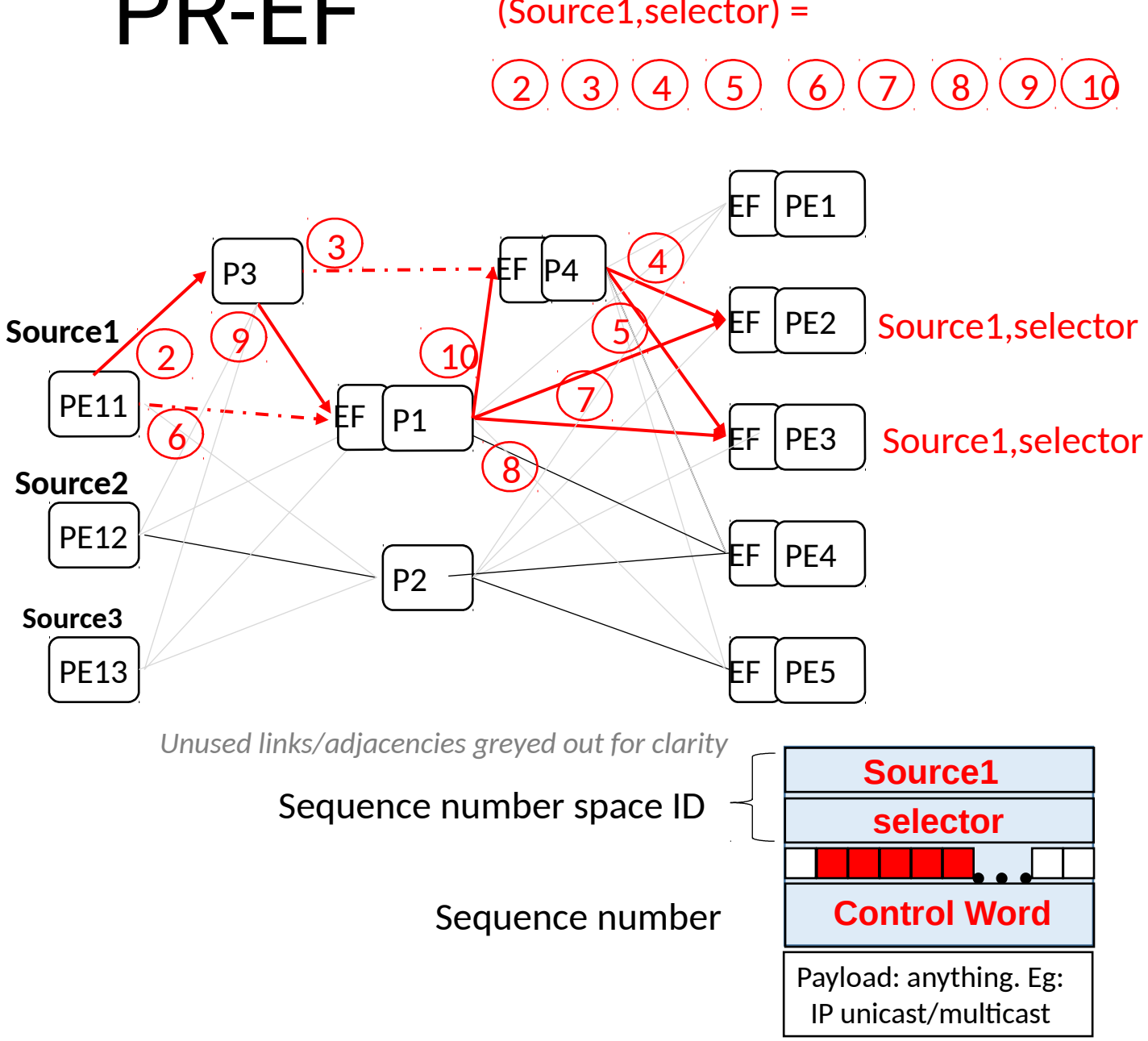
- Send packets with explicit path, unicast/multicast
  - Path is set of bits, one for each adjacency/interface
- Network device examines direct adjacency bits
  - P1: 7, 8,9 (ignore all other bits)
  - Copy to each adjacency with bit set in bitstring
- Sender can set bitstring bits individually for each packet
  - No need for “flows”

PR-EF



- Sender inserts BIER header fields
  - Sequence number (proposed BIER-TE header extension)
  - Sequence number space ID
    - Source, Selector
  - Selector could be per destination (unicast), per set of receivers (multicast)
    - BIER-TE independent choice:
    - Largest number of in-flight sequence numbers
    - Undesirability of sequence number gaps
- Bitstring indicate replications for redundant copies
  - No logical different from copies made for “multicasting”.
- EF node
  - Any node – not only receiver
  - EF on P1, P4 overcome for example simultaneous failure of links with 6 and 3

PR-EF



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OAM for PREF

- BIER-TE resets bitstring bits when they are used
  - “used” == Copy made across adjacency

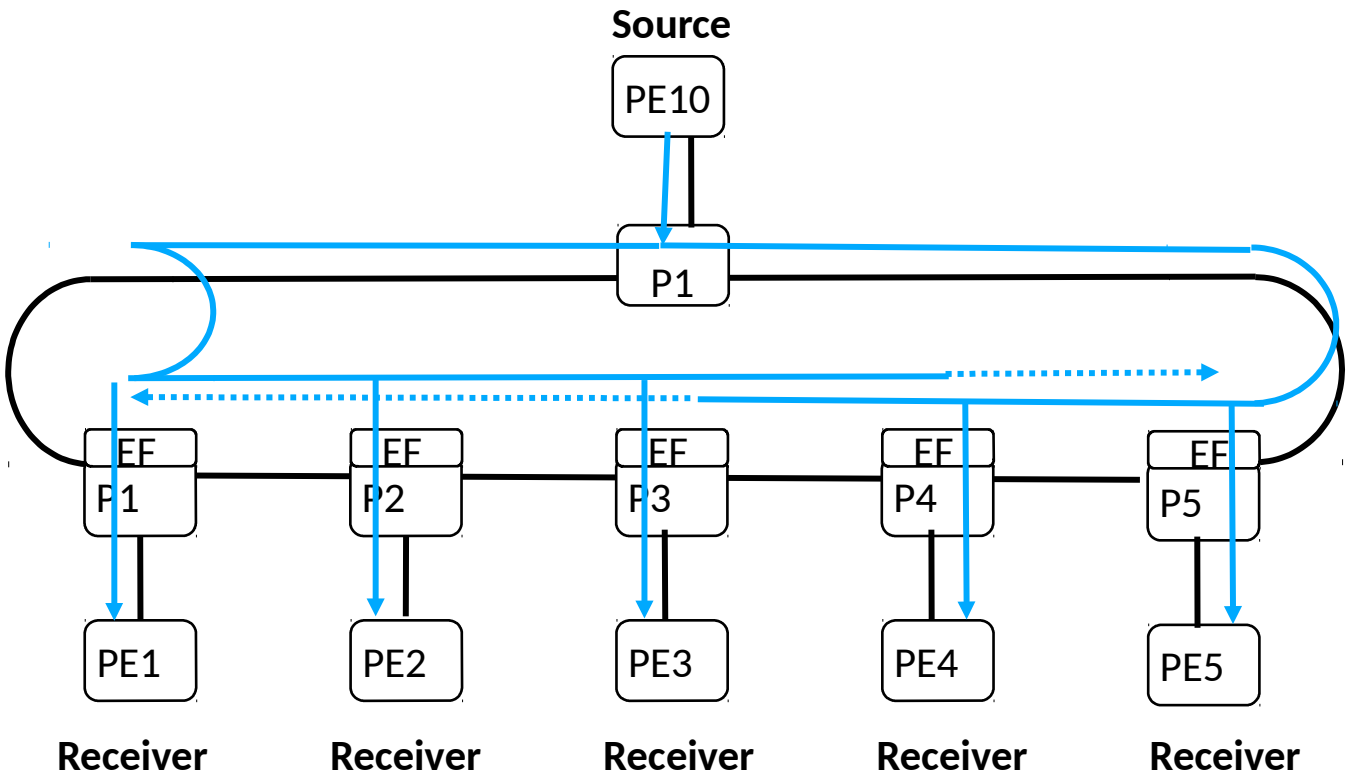
- Receiver will see the remaining bits of bitstring from received packet
- Prior slide: If interface-3, interface-6 fail:
  - Bitstring will include bit 3 and 6 – no failure: bits 36 should be cleared

- Receiver may know sender bitstring of packets
  - E.g.: associated with sequence number space ID

- Can identify in many cases very well which path was taken
  - Distinguish copies across different path

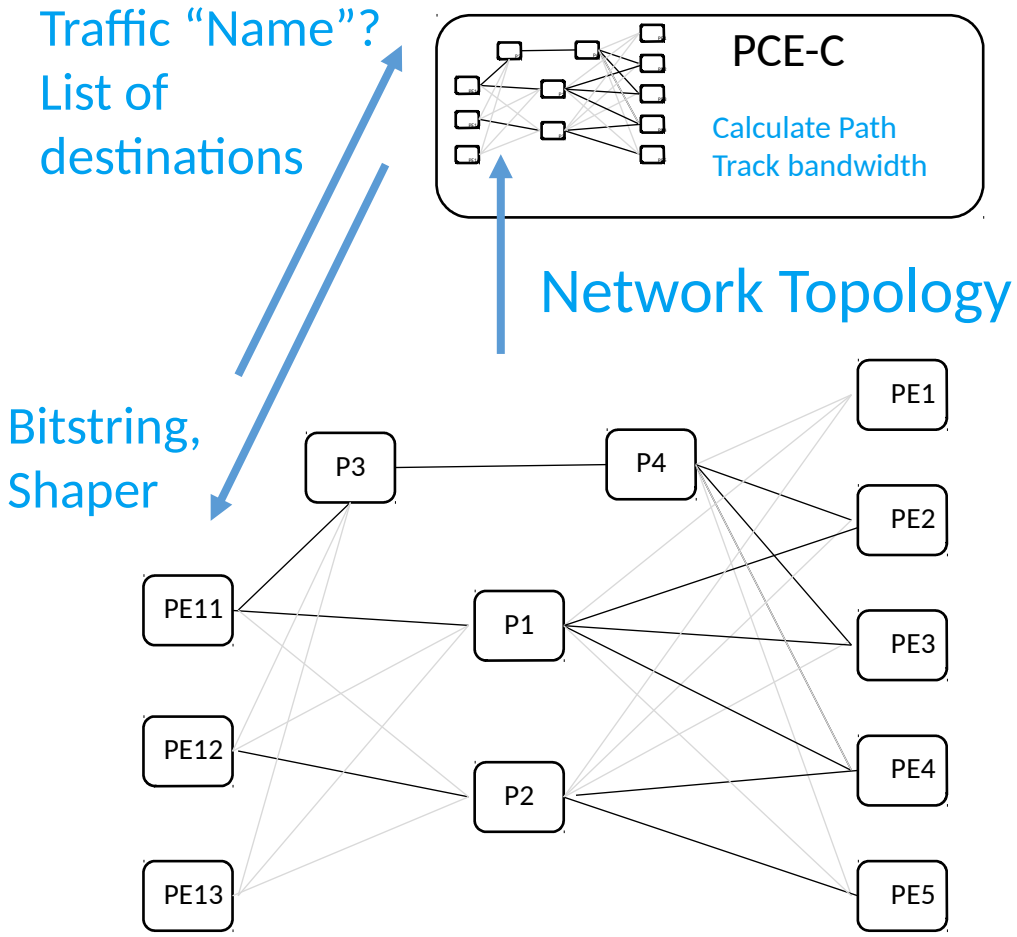
- Can couple with statistics, OAM alerts, …

BIER-TE Multicast ring example



- Ring example
  - Bits set so traffic will replicated in P1 to go clockwise until P1 and counterclockwise until P5
  - Bits likewise set so each PE1…PE5 will receive a copy
- Ingres EF will avoid dual copies P1..P2..P3 and P4..P5:
  - When clockwise packet arrives at P3, counterclockwise packet was already there. Clockwise packet dropped – before replication towards P2/P3
  - Likewise on P4 for counterclockwise packet.
- Location of overlap (P3 – P4)
  - Purely based on delay towards every node clock, counterclockwise

Bandwidth management: PCEC



- BIER/BIER-TE
  - Keep intermediate nodes (“P”) free of traffic based state.
  - DetNet requirements may introduce state such as EF though
    - Not if EF is per-source (ingres PE)>
- Highly desirable model ?!
  - Ingres PE shaping/marking/policing
  - Bandwidth broken /management on PCEC
  - PCEC based calculation of bitstrings, signaling back to sender PE

BIER vs. BIER-TE

- BIER bits only indicate receivers, not paths
- But can still build redundant paths
  - Dual-topology IGP or similar “disjoint path” calculations (e.g.: MRT)
  - Opinions about complexity / preferences of explicit paths (BIER-TE) vs. multitopology widely varying..
- Need to send from ingres N packets (one for each “copy”)
  - Differ in header field indicating the topology
- Duplicate elimination works unchanged
  - Does not care about “topology” field
- OAM options will not work
  - Based on received parsth bits in BIER-TE

- Solution overall should support BIER/BIER-TE

References

- RFC8279 – BIER architecture / forwarding
- RFC8296 – BIER encap MPLS/non-MPLS (no sequence number)
- draft-ietf-bier-te-arch – BIER-TE architecture / forwarding
- draft-thubert-bier-replication-elimination - PREF/OAM
- draft-huang-bier-te-encapsulation – BIER-TE encap (sequence num)
- draft-eckert-teas-bier-te-framework – BIER-TE TE framework
  - More references in this draft
  - Possible place to summarize mapping of BIER-TE technologies to DetNet into framework document