draft-opsawg-evans-discardmodel

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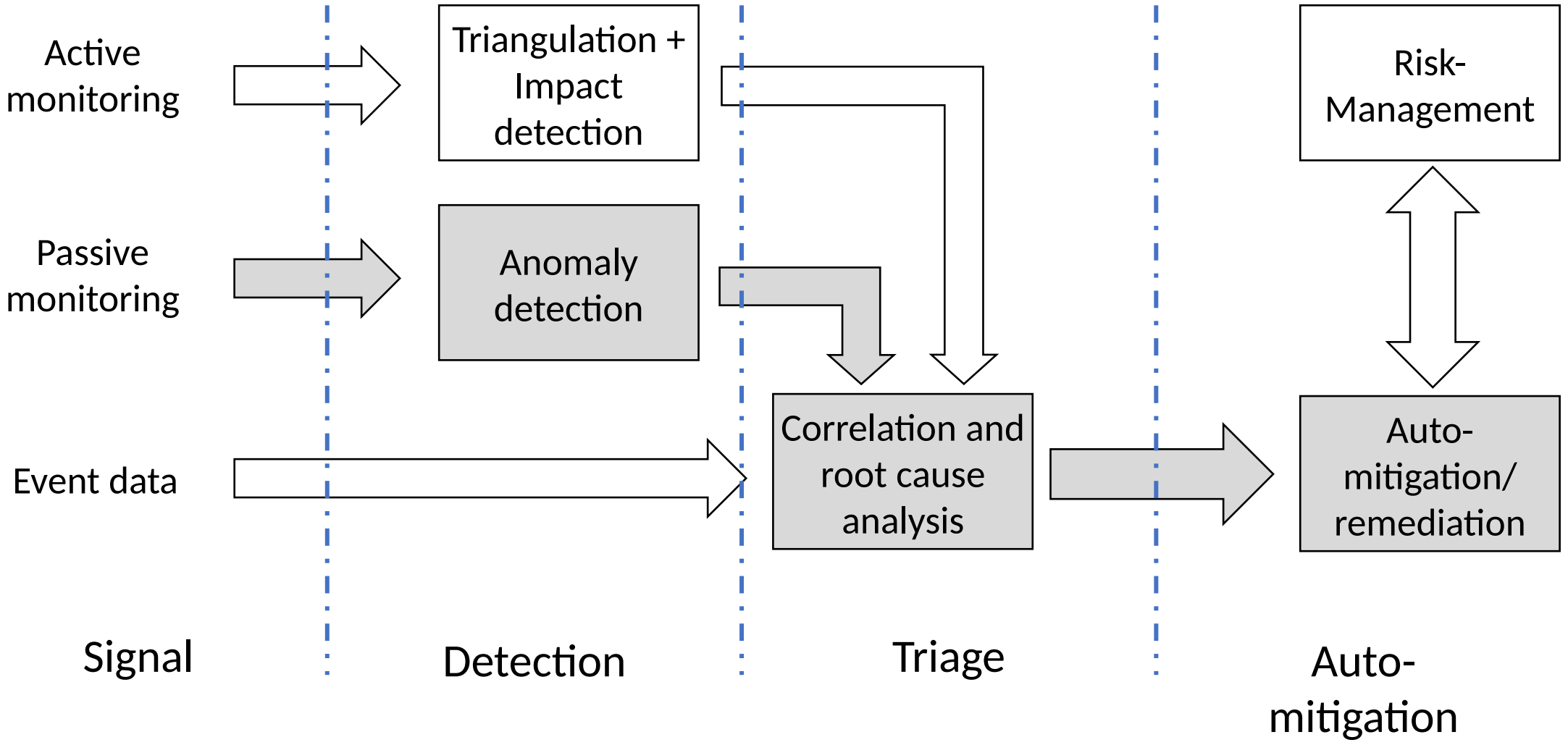
Problem statement 1

- The job of a network is to transport packets
- Packet loss is the primary signal of when a network is not doing its job
- But some level of packet loss is normal in TCP/IP networks
- How can we minimize anomalous packet loss through automated network operations?

Operational Context



Problem statement 2

- How can we report packet loss …
  - … with sufficient accuracy that we can detect anomalies (even low-level)
  - … and sufficient context that we can apply appropriate auto-mitigation actions
    - … which device?
    - … what’s the cause?

Working backwards from auto-mitigation

- There are only a relative small number of auto-mitigation actions
  - Take a device / link / set of devices and or links out of service
  - Put a device / link / set of devices and or links back into service
  - Roll-back a change
  - Move traffic
  - Escalate to Network Operators

- Precise signal of impact is important – taking the wrong action can be worse than taking no action
  - Taking a congested device out of service can make congestion worse

MIB-II (RFC1213, 1991)

- ifInDiscards
  - *“The number of inbound packets which were chosen to be discarded even though no errors had been detected to prevent their being deliverable to a higher-layer protocol. One possible reason for discarding such a packet could be to free up buffer space.”*

- ifInErrors
  - *“The number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol.”*

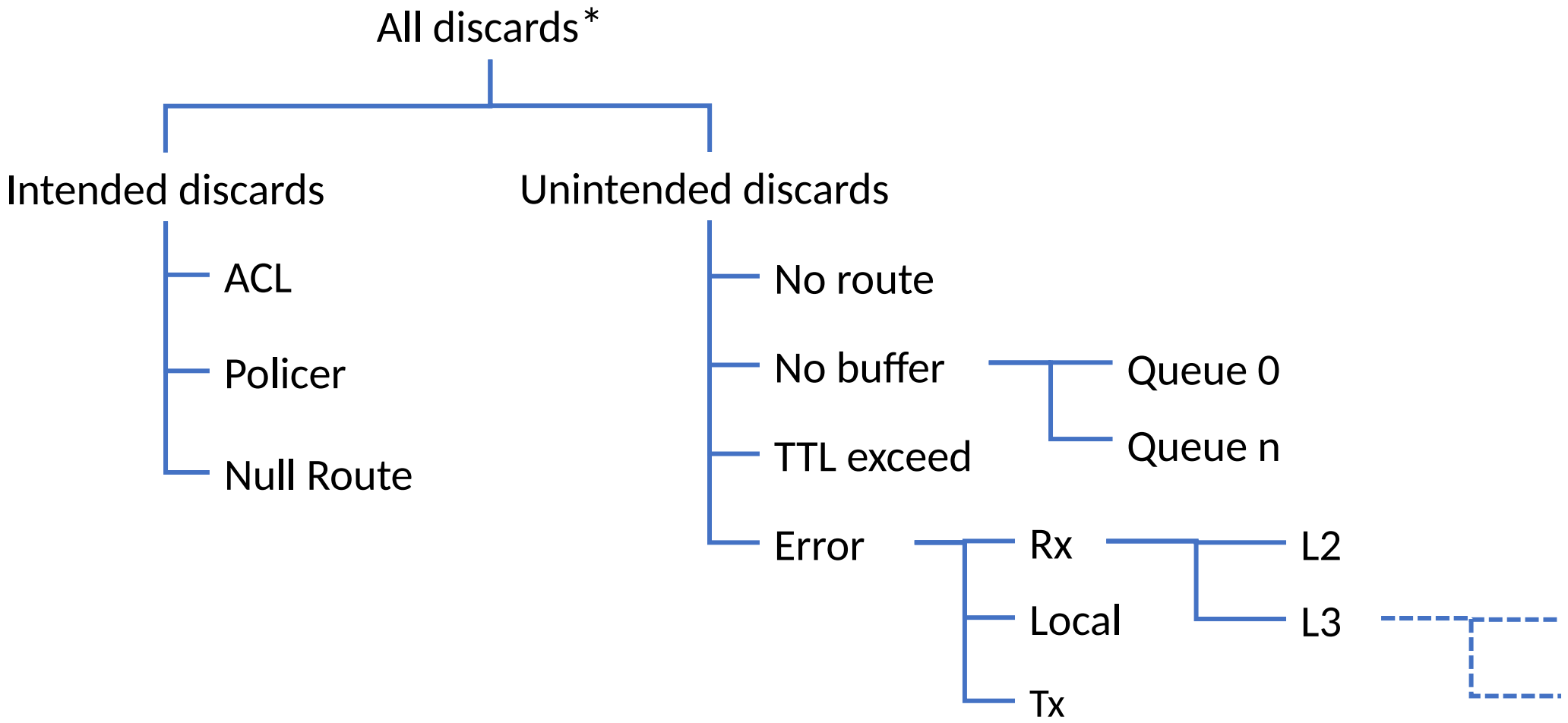
Implementation Inconsistency

- All vendors support more discard metrics than this – but they are inconsistently implemented
- Experience across multiple implementations and hardware platforms:
  - Not reporting all discards – appears like a grey failure
  - Duplicate reporting across discard metrics
  - Same OID can account for different types of discard on different platforms
  - ifInErrors can include non-discarded “errors” and discarded errors
  - Interface metrics vs. platform metrics vs. something in between
- There are no clearly defined semantics for packet loss reporting

Experience defining a new packet discard classification scheme

- We defined discard classes working backwards from auto-remediation
- Defined discard semantics
- Mapped the underlying hardware drop counters to the discard classes
  - Across multiple hardware platforms
  - From 64 to 256 underlaying hardware drop counters, depending on platform

Discard classification scheme



* Also need packets sent

Semantics Matter

- TLDR:
  - Report all packet drops …
  - … once and only once …
  - … where they occur …
  - … in the right class

- Long version: https://datatracker.ietf.org/doc/draft-opsawg-evans-discardmodel/

Reason → Cause → Action mappings

Drop reason	**Direction**	**Drop Cause**	**Loss rate**	**Loss duration**	**Customer impacting?**	**Possible actions**
ErrorRxL2Discards	Ingress	Upstream device or link error	>0(Anomaly)	O(1min)	Y	Take upstream link or device out-of-service
TTLDiscards	Ingress	Tracert	<=Baseline		N	no action
TTLDiscards	Ingress	Convergence	>Baseline	O(1s)	Y	no action
TTLDiscards	Ingress	Routing loop	>Baseline	O(1min)	Y	Roll-back
…	…	…	…	…	…	…

Implementation experience

- Number of discard classes is a compromise
  - Enough granularity to take the right action
  - Too much information – can slow down resolution rather than help to surface the problem quickly
  - Volume of data for per interface metrics
- Null route vs. no route discards
- To CPU ACL vs. transit ACL discards
- Responded TTL expired vs total TTL expired
- Cannot detect config error without additional context

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- Information model + semantics rather than data model [RFC3444]
- Result of implementation experience
- Possible subsequent data models for NETCONF/Yang or IPFIX
- Related NANOG presentation:
  - https://youtu.be/FixkCbixgMM?feature=shared