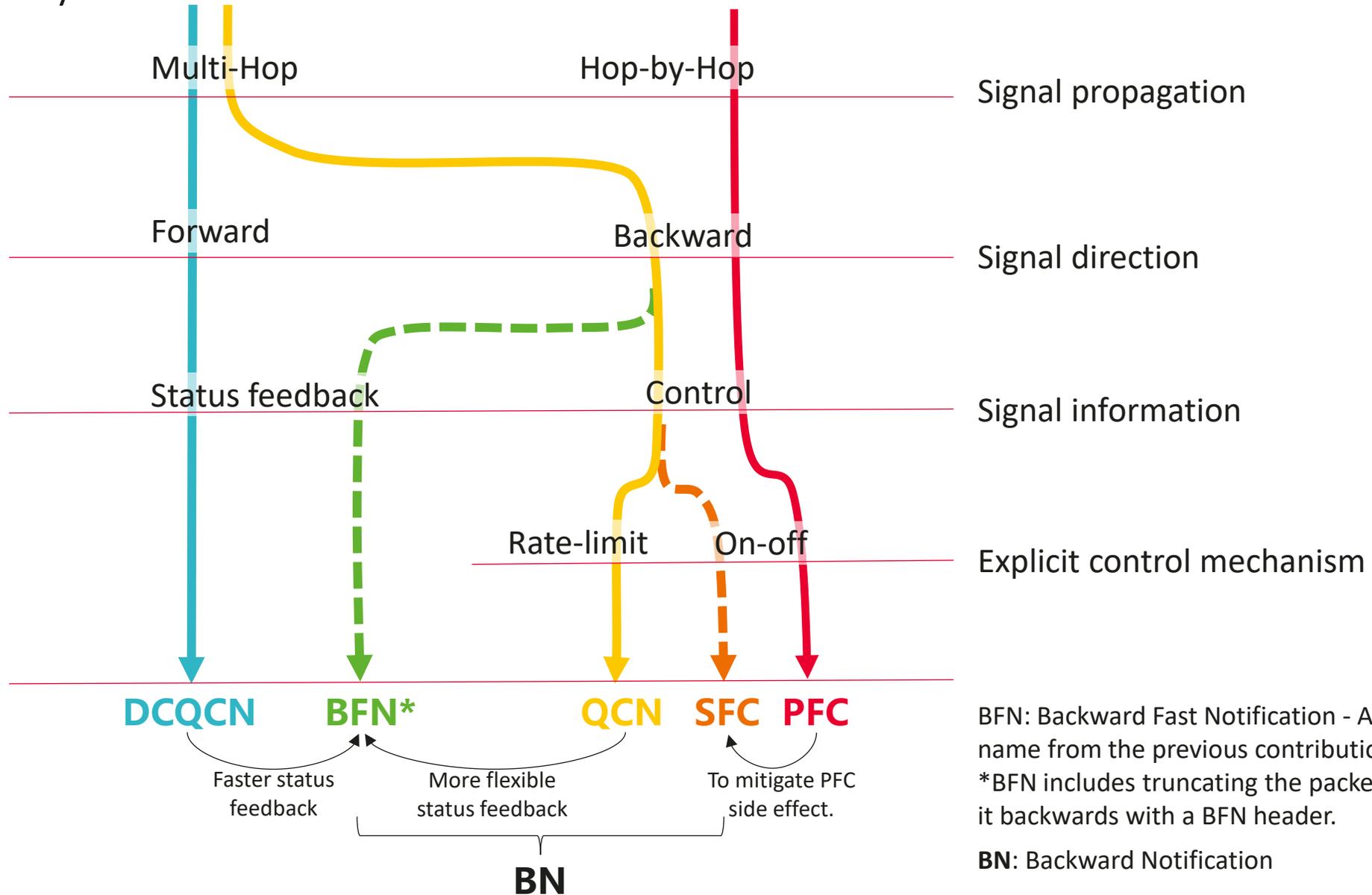


Backward Notification signals and scope

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Taxonomy of discussed solutions

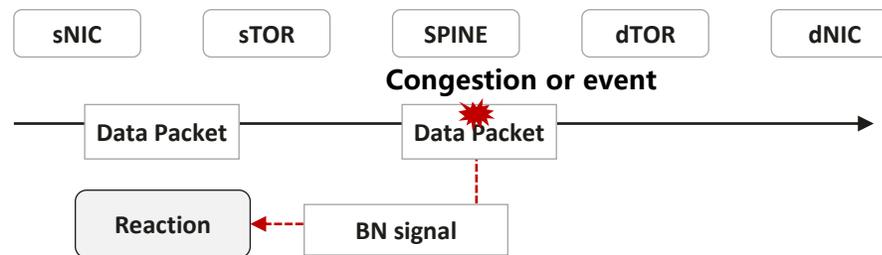


BFN: Backward Fast Notification - A temporary name from the previous contribution.
*BFN includes truncating the packet and sending it backwards with a BFN header.

BN: Backward Notification

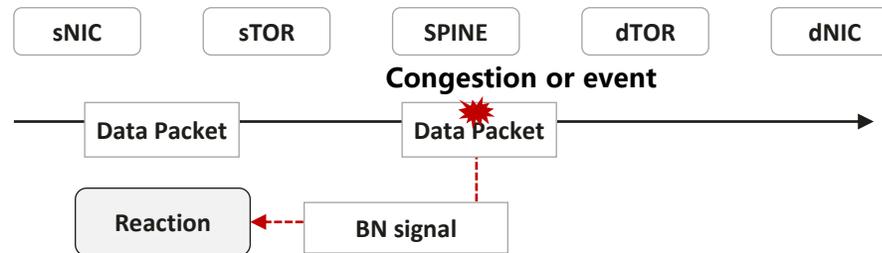
What do we mean by BN signals

- Backward Notification (BN) mechanisms share three properties:
 - > Congestion or critical event is detected by a switch (queue depth, buffer occupancy, drop, trim, link failure, etc.)
 - > A signal propagates upstream (in-band or out-of-band)
 - > The sender changes behavior (rate, window, path/EV, replication, or scheduling)
- The differences are:
 - > How far back the signal goes (one hop vs. to the sender)
 - > Who responds to the signal (upstream switch or end-station)
 - > What form the signal takes (packet, mark, tag, control message)
 - > What caused the signal (congestion drop, congestion experienced, path failure, XYZ threshold crossed)



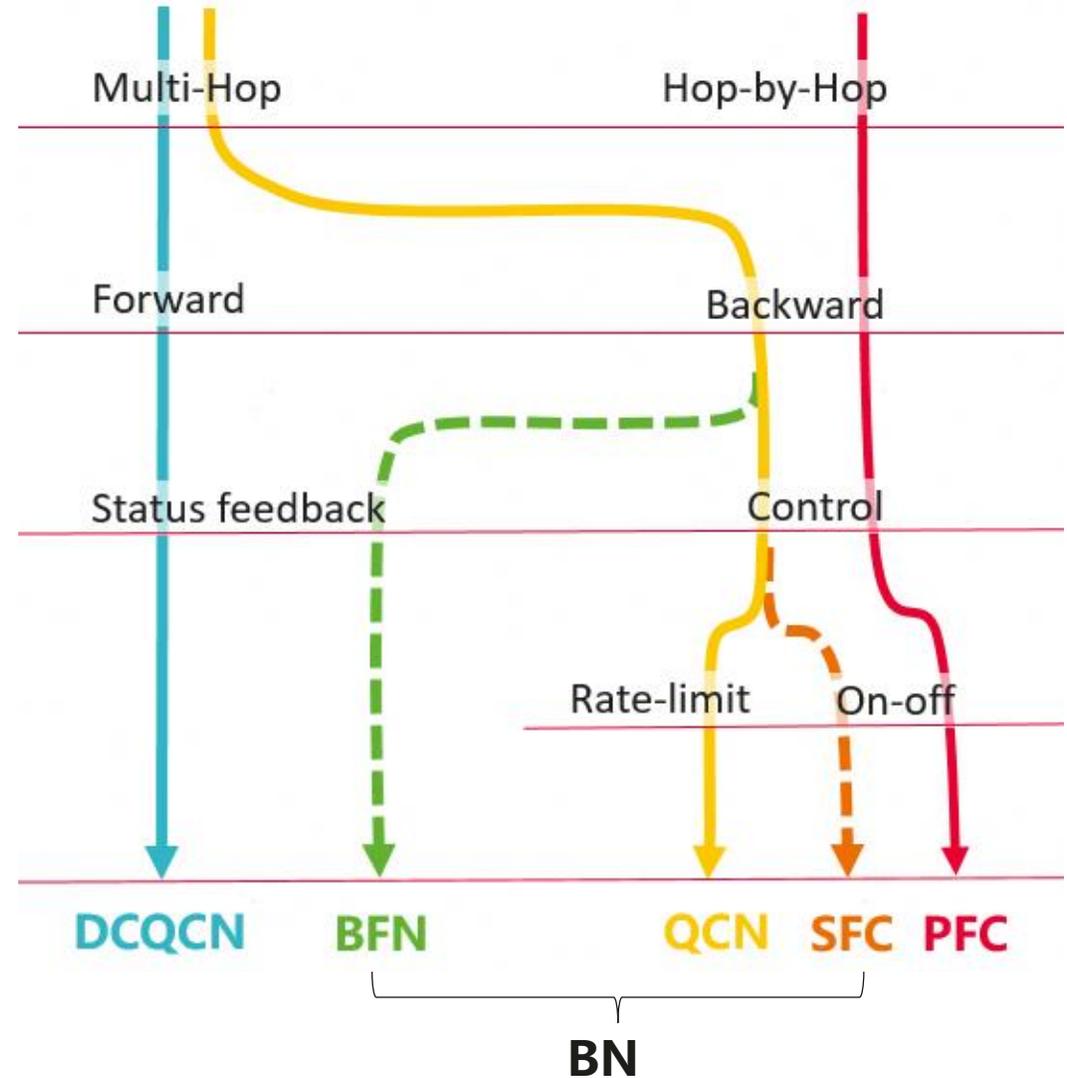
What are BNs good at?

- Shorter congestion control loop – faster feedback
- Rapid error detection and reporting
- Push urgent network conditions backward to alter subsequent paths (e.g., remote link failures rather than waiting on RTO)
- Feedback is not subject to delays from coalesced ACKs or receiver ACK timing
- Feedback can be explicit and not subject to sender having to choose which signal to monitor (e.g. CSIG)

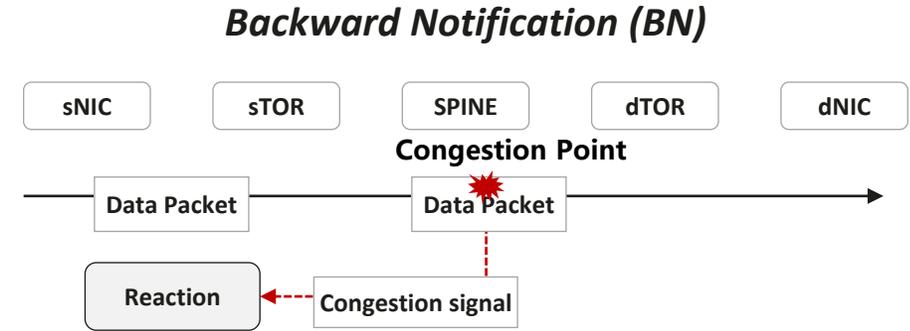
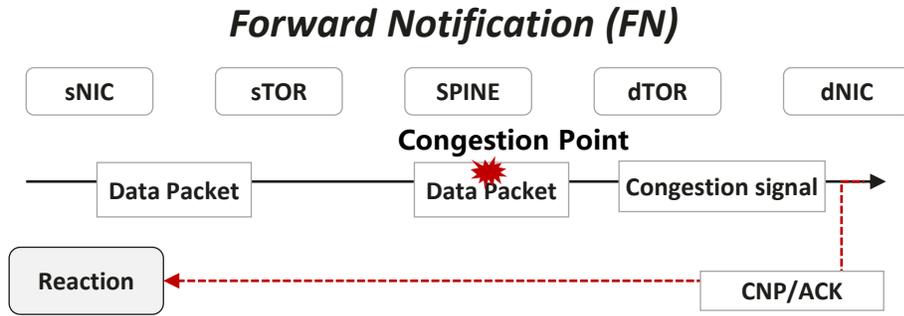


Types of BN messages and industry efforts

- Priority-based Flow Control (PFC)
- Source Flow Control (SFC) / remote PFC
 - > <https://support.huawei.com/enterprise/en/doc/EDOC1100518851/a390b2b1/understanding-rpfc>
- For congestion control: L3 version QCN / FastCNP (BN version of DCQCN)
 - > <https://docs.broadcom.com/doc/BCM78919-PB>
 - > <https://cloudswit.ch/whitepapers/fast-cnp-congestion-notification-technology/>
 - > UEC related works (see next page)
- BN Telemetry / Global Load Balancing (GLB) congestion status heartbeats
 - > <https://www.broadcom.com/blog/cognitive-routing-in-the-tomahawk-5-data-center-switch>
 - > <https://blogs.juniper.net/en-us/industry-solutions-and-trends/avoiding-ai-ml-traffic-congestion-with-global-load-balancing>
- BN Trimming (BTS trimming)
 - > <https://blogs.cisco.com/datacenter/ultra-ethernet-for-scalable-ai-network-deployment#:~:text=Smarter%20congestion%20recovery,congestion%20and%20improving%20tail%20latency.>
- Hybrids



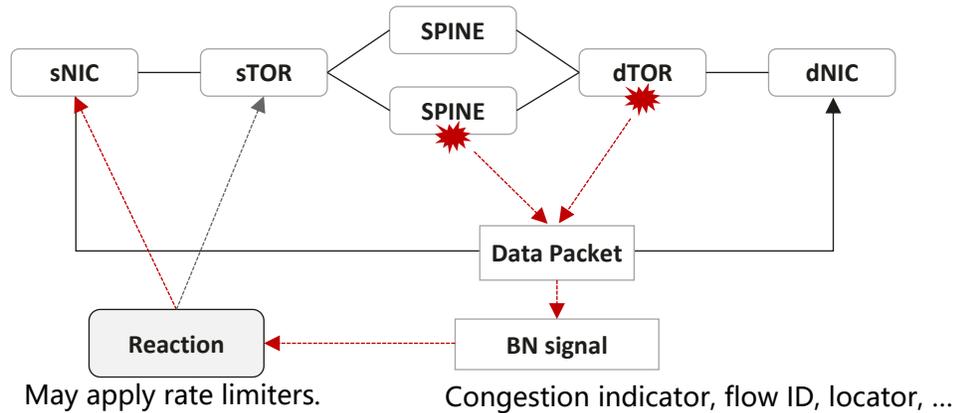
UEC related works



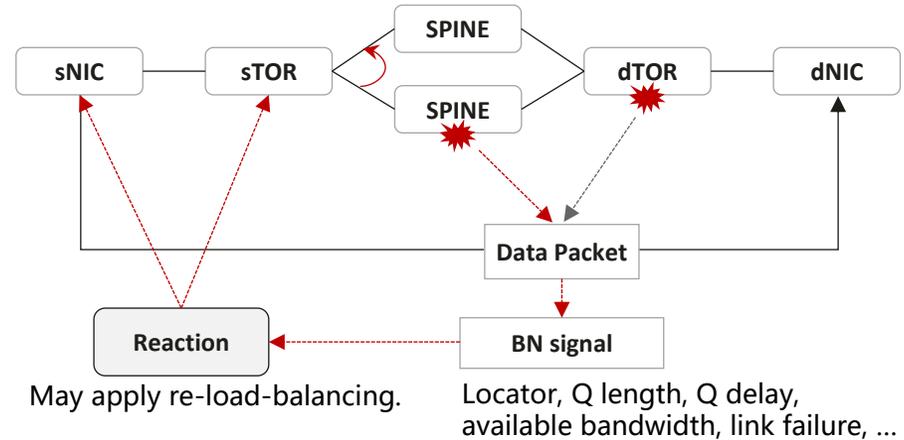
- UEC is standardizing Programmable Congestion Management (PCM), enabling anyone to implement new congestion control algorithms to address changing workloads using a standard language.
 - > <https://ultraethernet.org/accelerating-ai-with-open-standards-uecs-expanding-vision/>
- Important updates for the next iteration of the UEC spec include flexible congestion management mechanisms.
 - > <https://ultraethernet.org/uec-2025-in-review-preparing-for-what-comes-next-a-letter-from-uecs-chair/>
- UEC's PCM can be a consumer of BN signals.

BN protocol and use case examples

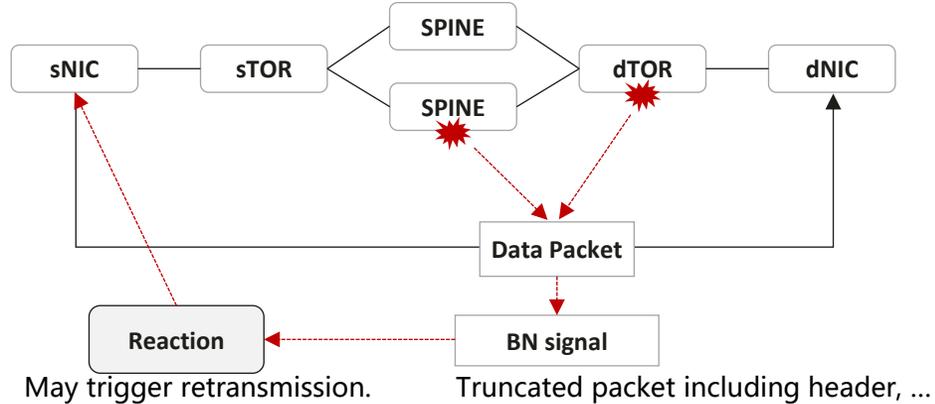
Use case: Congestion Notification



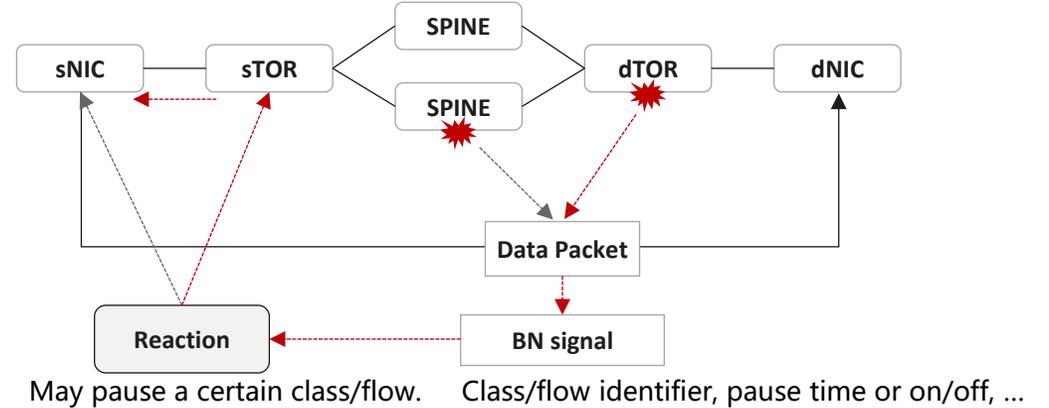
Use case: network state information



Use case: packet-related information



Use case: source flow control



Proposed Scope of Work

- Inspired by industry activities and the commonality of BN, we propose to expand Qdw scope to develop a BN protocol, in order to support broader use cases.
- Specifying BN protocol includes,
 - > Architecture.
 - > Operational Model: BN lifecycle overview (trigger -> construct -> send -> relay -> receive -> *act), state machine, flow identification mechanism.
 - > Congestion point BN procedures: Initialization, trigger mechanism, message construction, message sending, relay behavior, local processing.
 - > Reaction point BN procedures: BN recognition and parsing, capability advertisement and execution of pause/rate-reduction (optional).
 - > BN message format.
 - > Variables and management.
 - > Security considerations.

Motion

- 802.1 authorizes the TSN TG to generate PAR and CSD for the backward notification for congestion signaling at the May 2026 interim session for pre-circulation to the LMSC.

Discuss