Ordered BECN

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Why BECN’s cause confusion

How to Fix it
Backward Explicit Congestion Notification

Source Switch 1 Switch 2 Destination

150 Mbps 50 Mbps 100 Mbps 150 Mbps

Time

The Ohio State University

Raj Jain
Backward Explicit Congestion Notification

Source

<table>
<thead>
<tr>
<th>Switch 1</th>
<th>Switch 2</th>
<th>Destination</th>
</tr>
</thead>
</table>

150 Mbps

Time

Illegal for Solution 2
BECN: Problems

- BECN’s from multiple switches can come out of order
- One BECN can overrule the effect of other
- BECN can actually increase the rate
Ordered BECN

- Each RM Cell contains a timestamp from the source
- Source ignores out-of-date information. Remembers the time up to which it has already acted
- BECN can not increase
  FECN can increase/decrease
- RM Cell contains BECN/FECN bit
- Out-of-date FECN’s are also ignored
Ordered BECN: Example

Source  Switch 1  Switch 2  Destination

150 Mbps

50 Mbps

150 [t=10, FECN]

100 [t=20, BECN]

50 [t=30, BECN]
OSU Ordered BECN Rules

- BECN is optional for switches
- BECN should be sent only if overloaded
- Source includes a timestamp in each RM cell
  The timestamp field is ignored by other nodes
- RM cells include BECN/FECN bit initialized to FECN
- The original RM cell is forwarded towards the destination.
- A copy of the RM cell with BECN/FECN bit changed to BECN is returned to the source
- The source remembers the timestamp of the last BECN/FECN RM cell received
- All BECN/FECNs with earlier timestamp are ignored
- All BECN that would result in rate increase are ignored
BECN Rules

- BECN: When a switch generates an RM cell destined for the source when the switch is not acting as a virtual destination.
- RM cells include BECN/FECN bit initialized to FECN.
- All BECN that would result in rate increase are ignored.
- BECN is optional for switches.
- BECN should be sent only if overloaded.
- The original RM cell is forwarded towards the destination.
- A copy of the RM cell with BECN/FECN bit changed to BECN is returned to the source.
- BECN can be sent on the “First RM” cell.
- If the source has received an RM cell from the destination, then no switch should generate a BECN.

=> Need “Not yet heard from destination” bit in RM cells.
Subsequent BECN Solutions

- Source ignores all BECNs that result in rate increase.
- Switch does not generate a subsequent BECN if it has seen other reverse RM cells for this VC. => Need bit per active VC in the switch
- The source includes a timestamp in each RM Cell and remembers the timestamp of the last BECN/FECN RM cell acted. Ignores BECN/FECNs with earlier timestamps are ignored.
Upstream Configuration

- All links 155 Mbps. Link 1: 1 km, Link 2: 1000 km
- Max-min optimal: 51.3, 51.3, 51.3, 103.6 Mbps
- Goal: To check that all unused capacity is allocated to S4
Summary

- Without a timestamp field, BECN’s can cause confusion.
- Need a timestamp field and BECN/FECN bit in the RM Cell.
- Need to specify rules for BECN/FECN usage.
- Sequence number can be used in place of timestamps. But, timestamp can also be used for round-trip delay estimate.