FURTHER SRS CONSIDERATIONS AND APPLICATION OF SRS TO TSN USE CASES

Szilveszter Nádas, Balázs Varga (A), János Farkas
{szilveszter.nadas, balazs.a.varga, janos.farkas}@ericsson.com

December 12, 2016
- Summary of experience of two years
- Description of the concept ad related work
- Conceptual description on how delay requirements and desired resource sharing can be decoupled
- Description of potential implementation
- Simulation results, e.g., how TCP traffic is protected from unresponsive traffic in the same queue
- Load balancing, resource balancing, feedback for admission control

We are extending the concept in a university cooperation

Further papers in progress
EXAMPLE SIMULATION

TCP TRAFFIC IS PROTECTED FORM UNRESPONSIVE TRAFFIC IN THE SAME QUEUE

Gold and Silver TCP flows. 3 Background UDP flows. 5 TCP connections per flow. Gold and Silver class has 1-1, 2-2, 4-4 flows
APPLICATION OF SRS TO TSN USE CASES
The possibility of forwarding non-guaranteed packets results in a larger achievable flow rate.

The packet value determines:
- Whether or not a packet is guaranteed
- Whether a non-guaranteed packet is dropped or forwarded (note: there can be more important and less important non-guaranteed packets)

The size of the larger bucket is chosen based on a compromise between (1) delay, (2) allowed total guaranteed rate, and (3) allowing excess traffic:
- In many cases, slightly increased delay is still within the E2E delay budget.

Recap:
- Combination of ATS & SRS

Loss vs. Throughput:
- ATS
- SRS + ATS
- Larger achievable rate
- Throughput
CRITICAL SPORADIC TRAFFIC AND ATS

- Some sporadic traffic can be quite critical, but actual traffic happens rarely – e.g., alarms
- ATS requires reservation for all traffic to guarantee lossless delay bounded delivery. This is not efficient from dimensioning perspective
- Some classes might be able to tolerate losses when critical sporadic traffic is present
CRITICAL SPORADIC TRAFFIC AND ATS

› Define classes
  - 1) critical sporadic
  - 2) critical-a
  - 3) critical-b (it tolerates losses when critical sporadic traffic is present)

› Dimension the link for 1+2 and 2+3 (take maximum)

› When class 1 is present,
  - Classes 1 and 2 are included in interleaved shaping and are guaranteed
  - Class 3 is treated as non-Guaranteed traffic

› When class 1 is not present include classes 2 and 3 in Interleaved shaping and they are guaranteed traffic
  - Detect presence of class 1 by its token bucket being not full

› (Can be extended for more classes of sporadic and critical)
Frame replication may require too much capacity
  – Sending and guaranteeing each and every packet on both links

Especially for less critical content,

We propose to
  – relax the guarantees and capacity demand,
  – while still having a chance for all packets to go through in case of link failure
In case of duplicate sending define two classes of flows

1) very critical
2) critical

The very critical traffic is sent with high PPV on both links
- Received even if a link is down or if one copy is corrupted

The packets of critical traffic are also sent on both links
- With medium PPV on one
- A low PPV on the other
802.1CB AND SRS – EFFECTIVE FRAME REPLICATION FOR TSN

› Treat high and medium PPV packets as guaranteed in ATS (low as non-guaranteed)
  - As any packet is medium on at least one link, every critical packet is received within the delay limit if
    › both links are up
    › no packet is corrupted

› If a link is down or a medium PPV packet is corrupted there is still a chance that some extra critical traffic with low PPV goes through the other link if the traffic there is smaller than allocated (low PPV packets might go through)
  - The medium and low PPVs can be extended to PPV ranges to further represent the importance of packets

› The latent error detection function is updated to take into account the possibility of losing low PPV packets
Total capacity demand is \( L(1+r) \)
- \( L \) is the total load, \( r \) is the ratio of very critical traffic

The solution can be generalized to more redundant paths and more traffic classes.
A lot of analysis and simulations have been performed on SRS, more results to come

Combination of SRS with TSN solutions have benefits, e.g., more efficient bandwidth usage and dimensioning, which is valid for
- Combination of SRS with 8201.Qcr ATS
- Combination of SRS with 802.1CB FRER