

Multipath sequence maintenance

<https://tools.ietf.org/html/draft-amend-iccrg-multipath-reordering-02>

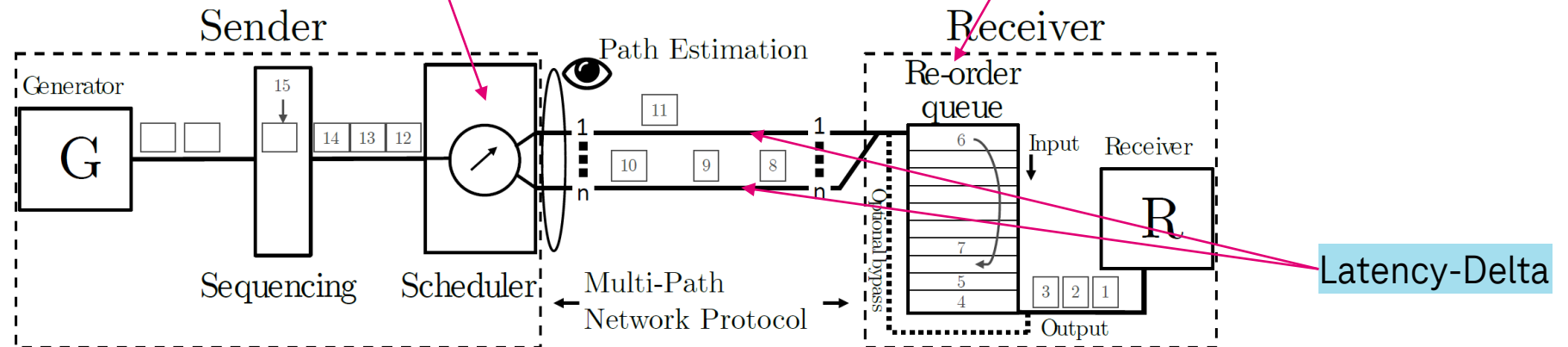


LIFE IS FOR SHARING.

Multipath communication and problem statement

draft-bonaventure-iccr-g-schedulers-01

draft-amend-iccr-g-multipath-reordering-02



Out-of-order delivery is caused in multipath communication from utilizing simultaneously heterogeneous paths/accesses and hence differs from the characteristic of single path communication.

Services with a certain expectation on data sequence and consistency will experience issues.

Multiple multipath protocols at IETF exists: MPTCP, MP-DCCP, MP-QUIC, CMT-SCTP

Typically scheduling and re-ordering are not part of the protocol specification and are left to implementers which might causes trouble if an implementation is dependent on protocol mechanisms.

MPTCP re-ordering is simple due to strict reliability...

...continue problem statement

... but there are MP protocols or combinations which claim to provide no strict reliable in-order-delivery

MP-DCCP,

CMT-SCTP + PR-SCTP,

MP-QUIC + QUIC Datagram

Those should consider sequence maintenance in their design which is not completely given.

Most often strict reliability is not an option and a solution will be a tradeoff between maintaining data sequence without interrupting the data flow. A special challenge for re-ordering mechanisms, is to deal with packet loss combined with the question how packet loss can be detected and distinguished from delayed packets? During the MP protocol design this has to be considered and possible measures like different sequencing schemes (path/connection) or sender/receiver signaling have to be taken into account.

draft-amend-iccr-g-multipath-reordering-02 claims to cover all this aspects and provide guidelines for designer and implementers of multipath protocols.

Discussed measures to support in-order delivery 1/2

Mechanisms discussed in the draft to provide and support smooth (adjustable) in-order deliver for multipath communication

- **Scheduling: Out of scope**, rather seen as part of draft-bonaventure-iccr-g-schedulers-01
- **Resequencing: Keep the generated sequence of data at receiver side**
 - Passive: Forward as arrived
 - Exact: Strict reliability (TCP like)
 - Static Expiration: Wait a certain time for missing packets
 - Adaptive Expiration: Wait a dynamic adjusted time for missing packets
 - Delay Equalization: Delay fast packets to match latency of slow path
 - Fast packet loss detection: Leverage path and connection sequencing

Discussed measures to support in-order delivery 2/2

- **Recovery: Overcome packet loss spending redundancy**
 - FEC: Forward-error-correction
 - Network Coding: Encode data and distribute across multiple packages

- **Retransmission: Overcome packet loss by re-transmission**
 - Signaling: Signal outstanding packets to sender
 - Anticipated: Predict a beneficial early re-transmission for re-ordering purpose
 - Flow-selection: Possibility to retransmit packages on a path different to the original one

Combinations of mechanisms are in principle possible and most probably useful.

Discussion

Please feel free to contribute <https://github.com/markusa/draft-reordering>

The draft is still under development and some content is not finalized. Is there any mechanism missing so far?

How to proceed with this draft? This question is also to be considered relevant for draft-bonaventure-iccr-g-schedulers-01.