HP-WAN Problems and Requirements

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IETF 122 @ Bangkok HP-WAN Side meeting

March, 2025

After the HP-WAN On-line Meeting

- **HP-WAN use cases:**
  - examples from OTT providers and R&E networks
  - use cases from non-dedicated networks like public operator's network

- **Agreed HP-WAN requirements:**
  - high-speed data transfer over WANs
  - scheduling of both the host and the network

- **Updated problem I-D (draft-xiong-hpwan-problem-statement-02)**
  - through consensus we narrowed problem space
  - clarification of issues between WIT/Transport and Routing areas
  - add description to align with the use case I-D from public operators
  - add a new (sub)section to discuss the transport protocols adaption

Requirements for HP-WAN

- **Requirements for high-speed transmission:**
  - **Massive data transmission**, high-volume data with high-speed transfer, e.g. the data speed of a flow could be at 2Gbps~1Tbps.
  - **Requested completion time**, the data transmission should be completed within a requested completion time, e.g. the completion time could be at minutes~milliseconds.
  - **Scheduled transmission**, traffic patterns could be scheduled by the sender, e.g. data volume, start time, finish time, service type.
  - **Long-distance transmission over non-dedicated WANs**, with multiple hops and domains, long RTT latency, routing changes, network congestion, packet loss and link quality fluctuations.
  - **Multiple flows should be able to co-exist** for data transmission over WANs.
  - **Different transport protocols adaption** , such as QUIC, TCP and RDMA etc.

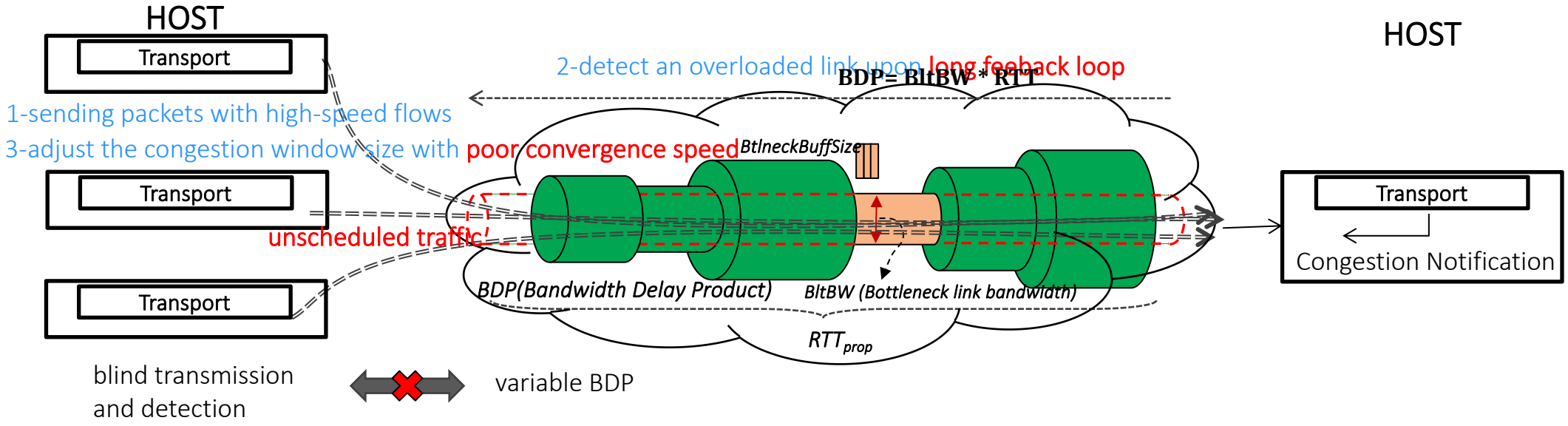
Technical Goals and Issues for HP-WAN

- The goals based on the use cases and the discussion on the list are summarized:
  - **Primary Goal: Completion Time**
    - The completion time for some applications should be at seconds or minutes.
    - The deviation of completion time for multiple concurrent flows within a job should be within seconds to avoid the long tail effect.
  - **Performance Goals :**
    - High throughput: ensuring the high-speed data transmission within a requested completion time for a flow, which could be impacted by the bandwidth, convergence speed, start time and RTT.
    - Efficient use of capacity: efficiently using available network capacity with fairness to maximize data transfer rates and minimize the completion time for multiple flows.

- The specific issues of HP-WANs may encompass a wide range of aspects:
  - **Poor Convergence Speed**
  - **Unscheduled Traffic**
  - **Long Feedback Loop**
  - **Complicated Adaption to Multiple Transport Protocols**

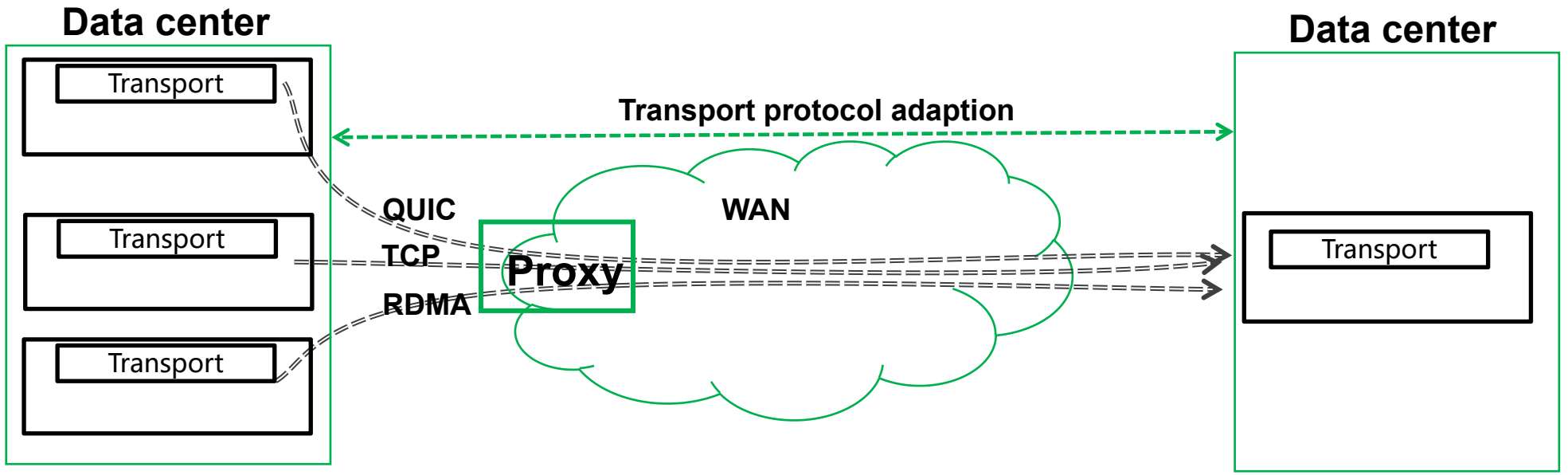
Problems Impacting the Completion Time

- The problems discussed in on-line meeting:
  - Poor convergence speed: the host performs blind transmission and adjusts sending rates by overloaded links detection while the WANs work as black box to provide unpredictable behaviours for high-speed transmission, leading to long convergence time comparing to the requested completion time.
  - Unscheduled traffic: the host sending traffic without collaboration will lead to the instantaneous congestion in WANs, prolong the completion time
  - Long feedback loop: it will delay the network status feedback due to the long-distance transmission delays and large RTT, resulting in the inability to adjust the transmission rate in a timely manner.



Problem with Complicated Adaption to Multiple Transport Protocols

- Multiple transport protocols (such as QUIC, TCP and RDMA etc.), will coexist within the same network and adapting these diverse transport protocols may entail significant overhead with encompasses issues such as redesigning congestion control algorithms, mapping parameters, adapting hardware components, and formulating QoS policies.
- It is also difficult to simultaneously ensure both encrypted data and high-speed transmission. e.g. edge computing nodes with limited CPU capabilities struggle to balance encryption and data processing.



Next Steps

- **Gaps analysis** with agreed problems such as differences between tsvwg, scone, ccwg, and other existing workgroups in the WIT area.
- **Discussions on the mailing list** are always welcome.

- **Thanks !**
- **Comments and suggestions are welcome.**