HP-WAN Documents Updates (State-Of-Art I-D and Framework I-D)

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HP-WAN Quick Reminder

- **Scope:** NRENs and large dedicated backbones supporting data-intensive science, distributed AI training, and HPC. Examples: GÉANT, ESnet, Janet, Internet2, CANARIE, CERNET.
- **Problem:** Multi-petabyte data movement across distance needs high bandwidth, low latency, high reliability, and secure end-to-end design from campus to backbone (e.g., Science DMZ).
- **Key components:** Distributed architectural elements, topology choices, bandwidth and latency engineering, localised data movement, forwarding optimisation, reliability/HA.
- **Data movement enablers**: Scheduled low-latency hard guarantees, QoS, congestion control, performance monitoring, scalability.

Two Important Documents

- **“Current State of the Art for High Performance Wide Area Networks”**
  - This document provides an overview of the terminology and techniques used for existing HP-WANs. It also explores the technological advancements, operational tools, and future directions for HP-WANs, emphasising their role in enabling cutting-edge scientific research, AI training and massive R&E data analysis.
  - https://datatracker.ietf.org/doc/html/draft-kcrh-hpwan-state-of-art-03

- **Framework for High Performance Wide Area Network (HP-WAN)**
  - This document defines a framework to enable the host-network collaboration for high-speed and high-throughput data transmission, coupled with fast completion time and low latency of High Performance Wide Area Networks (HP-WAN). It focuses on key congestion control functions to facilitate host-to-network collaboration and perform rate negotiation, such as QoS policy, admission control, and traffic scheduling.
  - https://datatracker.ietf.org/doc/draft-xhy-hpwan-framework/

“State of Art” Updates from Last Meeting

- **Updates draft-kcrh-hpwan-state-of-art from v-02 to v-03:**
  - Improved readability with updates to key sections
  - Focus on NREN R&E applications within the document, removing industrial examples.
  - Clarifying architectural elements
  - Inclusion of NREN/R&E examples from China
  - Further discussion on emerging topics, resources, and network control
  - Inclusion of additional references

- **Next Steps:**
  - We *think* the document is complete now.
  - A few deep reviews would be very welcome.

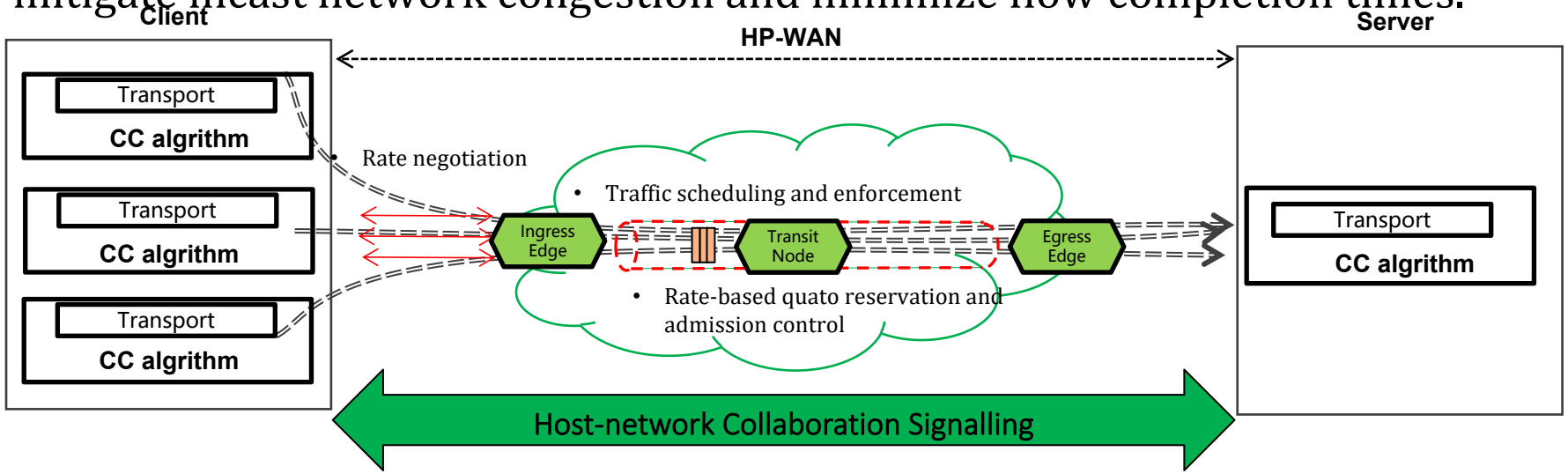
“Framework” Updates from Last Meeting

- **Updates draft-xhy-hpwan-framework from v-02 to v-03:**
  - adding the centralized approach for HP-WAN such as the implementation in SENSE
  - adding some clarifications for the congestions for slow flow and rate fluctuations due to blind competition among multiple flows
  - adding security considerations

- **Next Steps:**
  - The HP-WAN mechanisms mentioned in this framework will be implemented and simulated in Hackathon.
  - We appreciate more contributions and feedbacks.

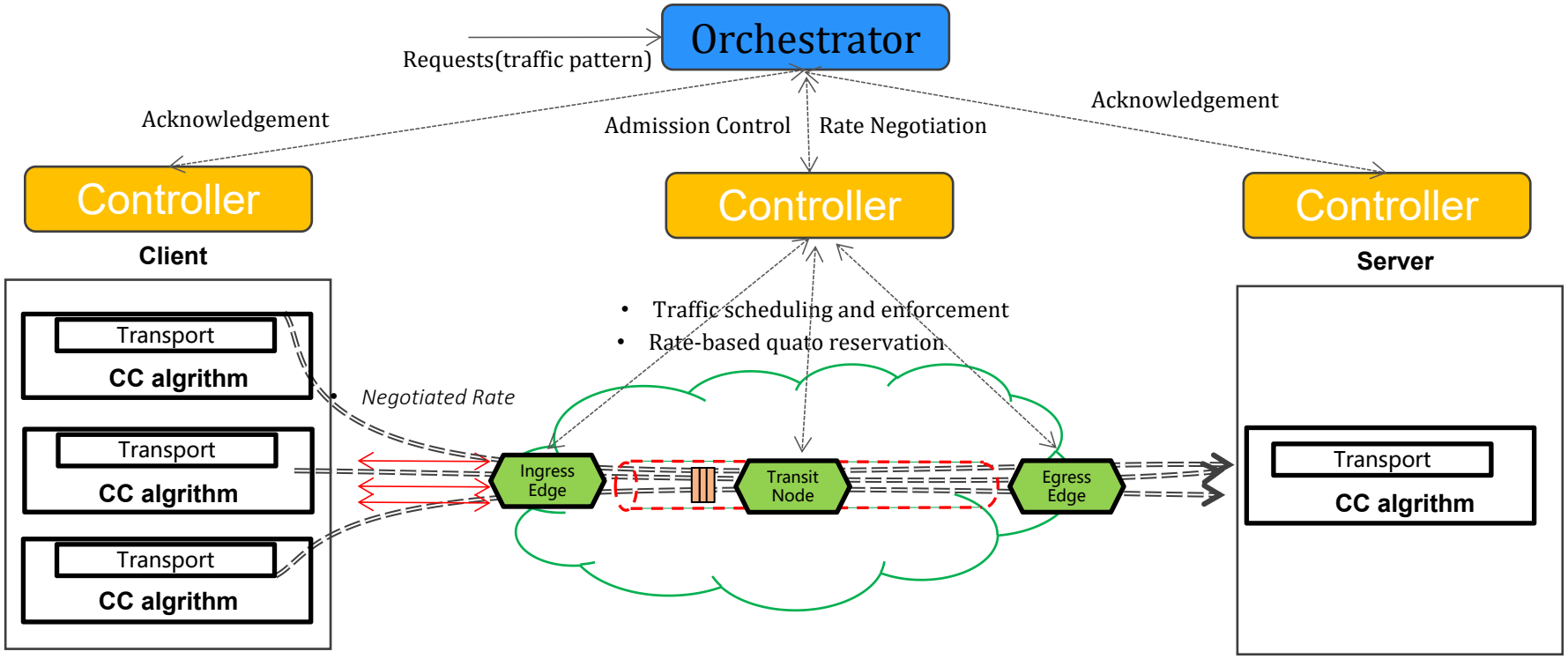
Host-network Collaboration in Distributed Signaling

- The host-network collaboration signaling is enabled to enhance the congestion control in HP-WAN.
  - The client and server could send the traffic efficiently with the negotiated rate- based congestion control in a fine-grained way.
  - The network could provide rate-based quota reservation and admission control to achieve predictable network behaviour.
  - The edge node could enhance the capability to provide traffic scheduling and enforcement to mitigate incast network congestion and minimize flow completion times.



Host-network Collaboration in Centralized Configuration

- Host-and-network collaboration could also be performed using configuration in centralized model where a controller or an orchestrator orchestrates data processing and resource allocation across hosts and network infrastructure.
  - The request of scheduled traffic will be initialed to the Orchestrator.
  - The Orchestrator will perform rate negotiation among hosts and networks.
  - The controller of the network will perform admission control and acknowledge the traffic.
  - The Acknowledgement will be configured to the client, including the response with the negotiated rate and QoS policy for the client to send traffic.
  - The Controller of the network will reserve resource quota to guarantee the job's completion time.



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