Scenarios and Deployment Considerations for High Performance Wide Area Network

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Agenda

- Introduction
- Typical Scenarios for HP-WANs
- Deployment Considerations for HP-WANs
- Comments and questions

Introduction

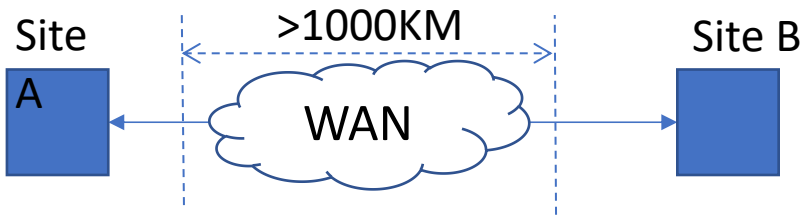
- HP-WAN performance requirements for WANs:
  - low or zero packet loss rate
  - low latency,
  - high throughput
  - low CPU utilization,

- Challenges for the high performance in long-distance and wide area networks deployment

1. the high utilization and high throughput capabilities for long distance links;
2. the efficient congestion control mechanisms to avoid packet loss;
3. fair sharing of link bandwidth resources among multiple concurrent applications;
4. the packet ACK delay increases with distance, which will be challenging for high-performance applications, especially distributed processing models.

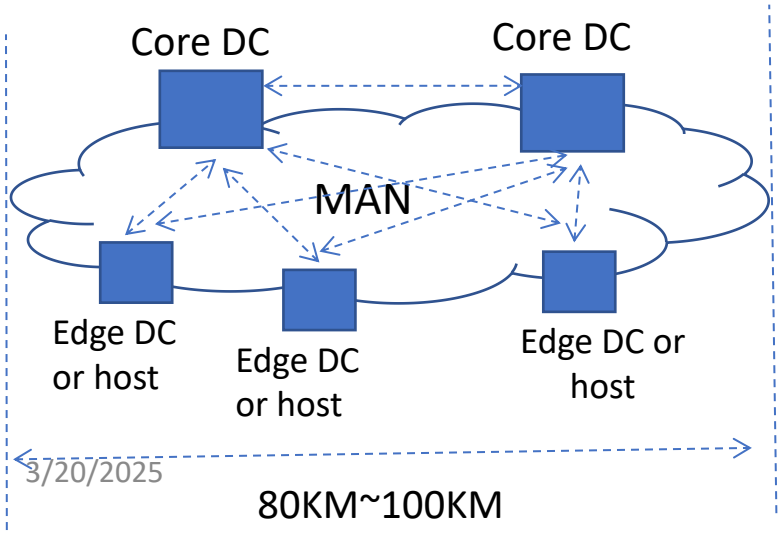
Typical Scenarios for HP-WANs

- Long-distance Data Transmission



- massive research data transmission between HPCs
  - •distance range from 100km to 1000km;
  - •regularly or in demand, data volume from a few terabytes to several hundred terabytes;
  - •Balance on Data transmission costs and security
  - •The US ESnet6 and the EU EuroHPC ……
- data transmission of training samples between the DCs for AI
  - •distance range from n*100km to 1000skm;
  - •in demand
  - • training large models in the billions or trillions tokens for N*100 terabytes to P of corpus data.

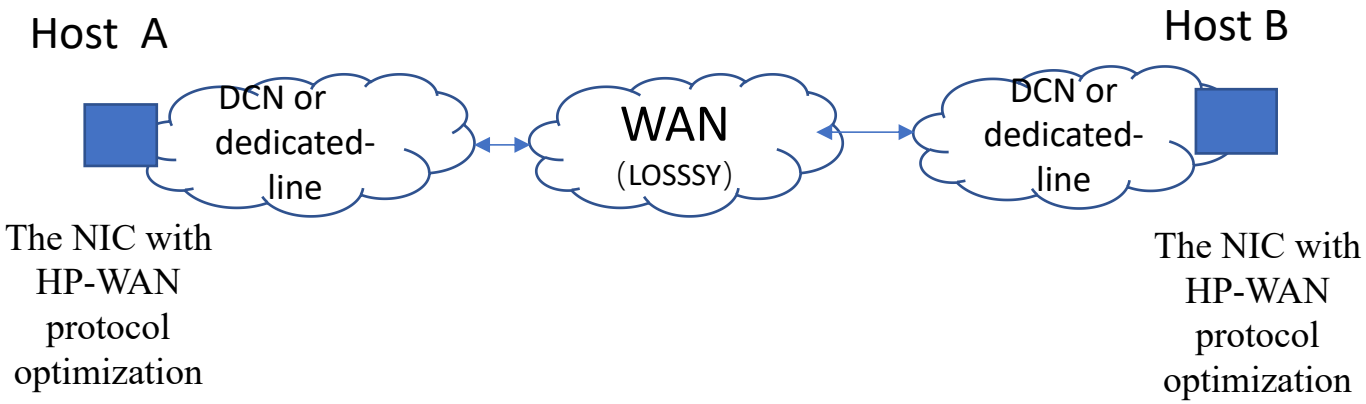
- Collaborative and Interactive Data Transmission



- data transmission between storage and computing separation data centers
  - •For energy limitation, deploy multiple DC with storage and computing separated in MAN ,e.g. In 2023, Amazon@100Gbps&100 kilometers;
  - •To avoid data leakage , storage in the customer's private DC and connected to the provider's DC for AI training through a wan.
- high-throughput data transmission between DCs under distributed intelligent computing
  - •Distributed Ai inference: AI inference at edge DCs with high user Experience;
  - •Distributed Ai training: Distributed Compute Aggregation.

Deployment Considerations for HP-WANs(1)

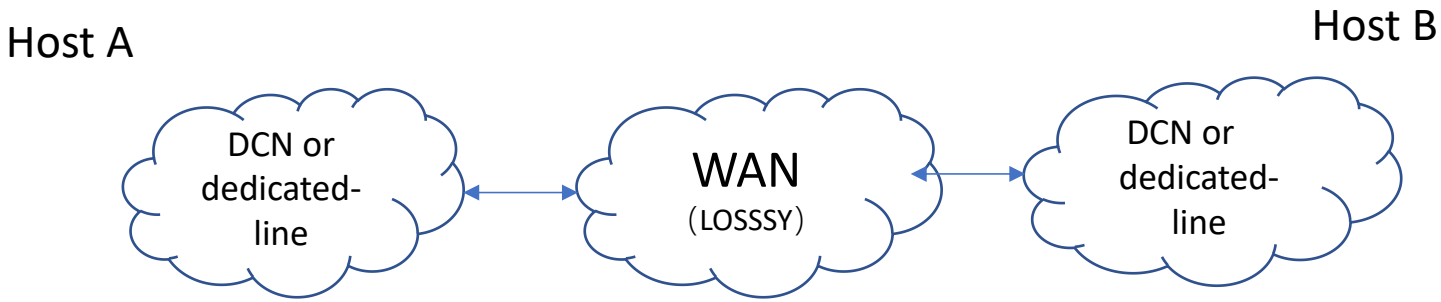
- 1. Host Optimization Deployment



- improved transport layer protocol on the NIC of host server to achieve long-distance and efficient transmission based on lossy networks.
- Optimization of the transport layer protocol may involve caching and resembling for out of order packages, packet loss tolerant and error correction mechanism based on lossy network, etc.

Deployment Considerations for HP-WANs(2)

- 2. WAN optimization Deployment

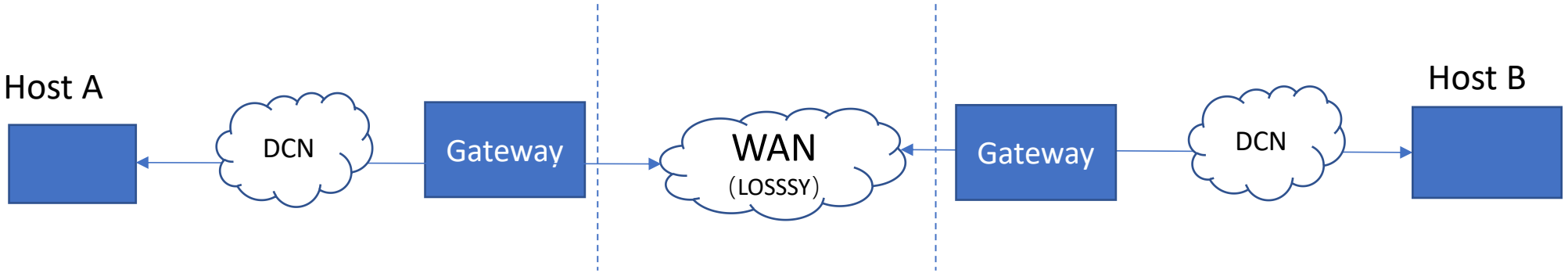


The optimization of packet loss, out of order, delay and jitter in HPWAN

- optimize the performance of packet loss, bandwidth utilization and latency to provide high-throughput data transmission at IP/optical devices between DCs .
- The optimization of wide area networks may involve path selection, congestion control and flow control etc.

Deployment Considerations for HP-WANs(3)

- 3. Gateway Deployment



- Newly deploy gateway devices at the DC edge to isolate or relay traffic within the data center and wide area network.
- The gateway devices should support high-performance services packet caching, buffering and retransmission.
- Implement the collaboration and Interaction between gateway and WAN through running optimized high-performance transport layer protocols for low packet loss, high bandwidth utilization, low latency and high-throughput data transmission between DCs .
- The optimization of wide area networks may involve path selection, congestion control and flow control etc.

Comparison and Analysis for HPWAN Deployment

Potential deployment solutions	Challenges	Scenario	Distance	Bandwidth	Timeliness
Host Optimization Deployment	Interoperability challenges with multi-vendor NICs and switches	On -demand , decentralized ,medium and low-speed , cost-effectiveness	80~ 100KM	N*10G~	medium/low
WAN optimization Deployment	Need to network transformation and update	Ultra-long-distance interconnection + large-scale interconnection	Over 1000KM~	Over 100G	medium/high
Gateway Deployment	scalability limitation, increasing investment and adding potential failure points.	Long-distance interconnection + medium-scale interconnection	Over 1000KM~	Over N*10~N*100G	medium/high

The “network” or “ Host ” solution alone encounter Challenges, “network” and “ Host ” collaboration may be a good choices!

Comments and questions

- Comments and questions are very welcome!

Thank You