

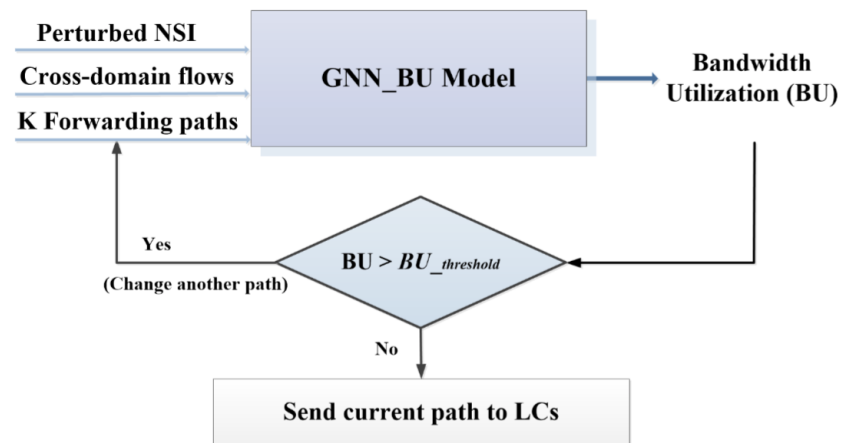
BI-TE: Achieving GNN-based Bandwidth Indistinguishable Traffic Engineering in Multi-Domain SDN

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Problems & Ideas

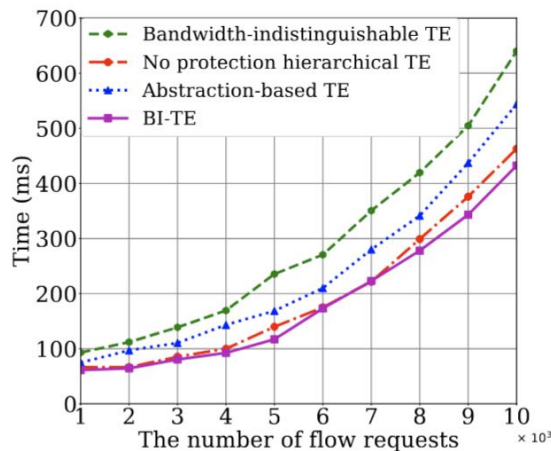
- Problems of privacy protection for multi-domain SDN traffic engineering:
 - Topology aggregation leads to frequent synchronization of controllers, resulting in high communication overhead.
 - Secure multi-party computing methods require frequent encryption and decryption operations, resulting in high computational overhead.
- Ideas: Differential privacy protection is performed on intra-domain information, and combined with the GNN model, cross-domain path calculation and communication time are reduced.



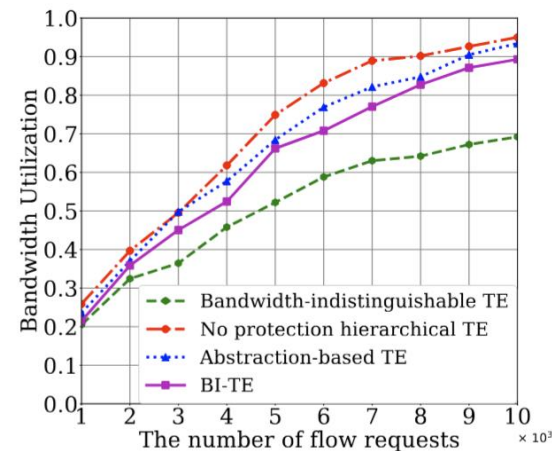
The perturbed network information, cross-domain requests and routing are input into the GNN model; Predict bandwidth utilization of the current path; If the predicted value exceeds the threshold, replace the current path with the next shortest path; Repeat this process until the predicted value is below the threshold; Select this path to start cross-domain transfer.

Main Contributions

- Contributions:
 - Random perturbation protects the topology structure;
 - Use differential privacy technology to protect the bandwidth information published in the domain;
 - Combined with GNN to train the bandwidth utilization prediction model;
 - The prediction model relieves the computational pressure of the root controller and reduces the communication overhead between controllers.



(a) Flow requests processing time



(b) Bandwidth utilization

Left: the processing time is reduced by 24.35% compared with TE based on topology aggregation and up to 38.49% compared with bandwidth-indistinguishable TE. Right: the bandwidth utilization rate is close to 90%, which is only 5.86% lower than TE based on topology aggregation and 21.03% higher than bandwidth-indistinguishable TE. A slight sacrifice in bandwidth utilization is achieved in exchange for a significant improvement in time efficiency.