Overlay Cloud Network

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1 INTRODUCTION

Motivated by the increasing global communication requirements, network giants have spent huge sums on their cloud backbones construction. Huawei's Overlay Cloud Network (OCN) is a low cost and high quality solution alternative to cloud backbones. The basic idea is to leverage today's abundant cloud resource to deploy an overlay network, and provide quality assurance on that network. The rich public cloud resource enables us to flexibly define an overlay network worldwide. On the powerful cloud overlay, we further apply intelligent routing and traffic control to offer probabilistic quality assurance. The running cost is very low because OCN runs on public Internet instead of dedicated lines.

We demonstrate how OCN runs on real Internet by a live streaming use case. We also illustrate the underlying techniques such as node selection and overlay routing. Fig. 1 shows an overview of the demonstration system. A video server supplies a live video stream to a user across continents using HLS. The green flow indicates the video streaming over OCN. It is directed to a nearest access cloud node and then routed to the end user along the shortest path on the cloud. The transmission on the cloud is packaged by a self-defined Overlay Transport Protocol. OTP applies hop-by-hop retransmission, early congestion detection, in transit detour and redundant transmission to offer quality assurance. The red flow stands for the default connection between the server and user via Internet. We give both the qualitative results and quantitative comparisons.

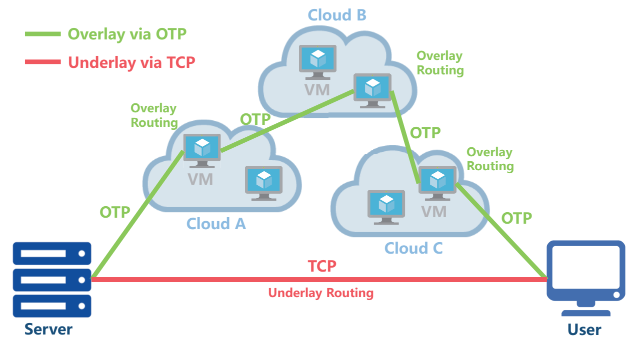

Figure 1: OCN demonstration system

2 SYSTEM DESIGN

The system mainly includes a live video streaming application, an OCN example runs on the cloud to bear that application, and a demonstration page to fully exhibit the results. OCN is the core of the system, which is made up of three parts, node selection, overlay routing and overlay transportation.

Node selection aims to select the best cloud nodes among a large number of candidates according to user requirements. The candidates are detected by crawling from world top 50 cloud vendors and Alex top 1 million websites. The node selection is formulated as a K-median optimization that minimizes the transmission cost between any node pairs. In this case, 229 candidate locations are detected over the world and 37 locations are selected as OCN nodes.

Overlay routing tries to select the best paths for transmission. The network topology is treated as a complete graph, where the vertexes are cloud nodes and edges are default Internet links. We conduct full mesh measurement on each node and perform network prediction using incremental linear fitting. Then the prediction results are used to calculate top K shortest paths. For different services, we offer delay, loss or throughput prioritized route tables.

Overlay transportation. We implement a self-defined Overlay Transport Protocol (OTP). It is packaged in UDP with an OTP header to record overlay route and flow id (for detour and multipath transmission) mainly. At the server and user side, the route tables are directed to a nearest overlay node using an OTP proxy. In OTP we apply advanced techniques to offer quality assurance, e.g. hop-by-hop retransmission, early congestion detection, in transit detour and redundant transmission.

3 DEMONSTRATION

We demonstrate OCN and compare it with the public Internet. We show the live video playing results via OCN and public Internet respectively. The statistical results such as video bitrates, bandwidth and video resolution histogram are also given for quantitative comparison. Besides, we illustrate the node selection and overlay routing techniques by animation and quantitative comparison. A video clip of our demonstration is available at https://youtu.be/UTEVW-r9nAI.