SDN (Software-Defined Networking)を活用し，すぐに災害復旧できるバックボーンネットワーク

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どんな研究？

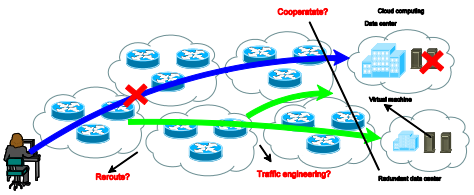
The current technology of Internet provides an acceptable level of resilience in normal operation. However, the Internet may get catastrophic impacts when unexpected disasters such as earthquake, tsunami happen. Especially, the Internet backbones face many challenges to normal operation including power outage, link, node failures, rerouting packets, traffic engineering etc. Therefore, it is necessary to research new technologies for fast recovery backbone networks.

何が分かる？

SDN（Software-Defined Networking）は、ネットワークの転送機能と制御機能を分離して構成する技術で、OpenFlowと言うプロトコルを使ってネットワークを、プログラムのように人間の意図通りに簡単に動作させることを狙った技術です。この研究は、SDN技術を活用して災害からすぐに立ち直ることのできるバックボーンネットワークを構築することを目指しています。SDNで災害で破壊されたバックボーンネットワークを復旧させる手法の長所と短所を検討した上で我々の解決策を提示するとともに、その評価結果も御紹介します。

SDN approach for disaster-resilient backbones

Goal : Keeping unstoppable Internet services during disasters

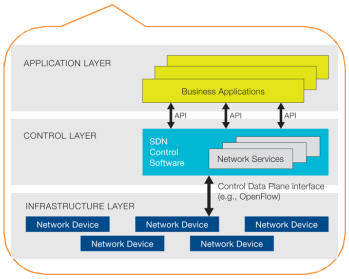


Limitations of the current technologies

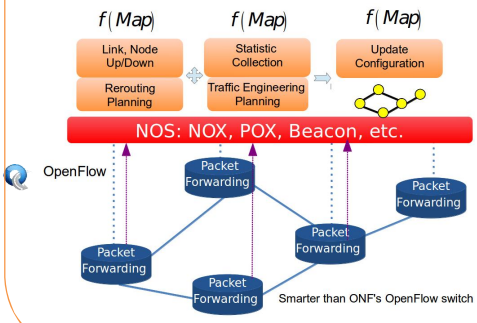
- Routing protocol (BGP, OSPF) long convergence time
- Extremely hard to debug and manage
- Not well cooperated with service provider (i.e., cloud computing)

Software-Defined Networking (SDN) architecture decouples the network control and forwarding functions enabling the network control to become directly programmable and the underlying infrastructure to be abstracted for applications and network services. The OpenFlow™ protocol is a foundational element for building SDN solutions.

OPEN NETWORKING FOUNDATION



Our current approach

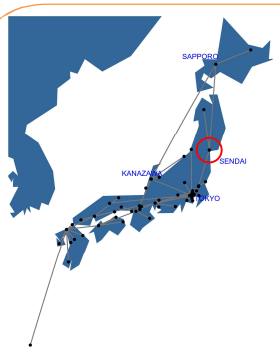


Challenges

① SDN at network backbone level?
② Fast failure detection and restoration
③ Efficient traffic engineering
④ Efficient cooperation with the service provision layer (later phase)

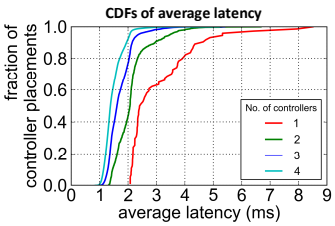
Network Operating system (NOS) has a global view of the network *f(Map)*

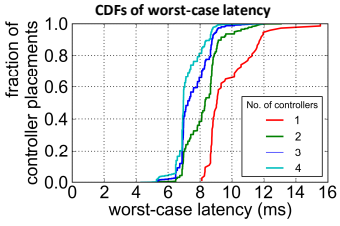
Performance evaluation examples

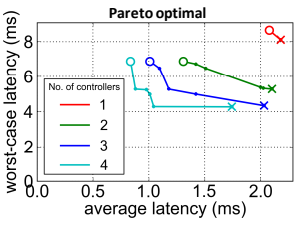


SINET3 is the Japanese Research and Education Network, operated by NII. The topology from http://www.topology-zoo.org/

Example 1: We investigate the latencies between controllers and switches in order to find the appropriate number and locations of controllers



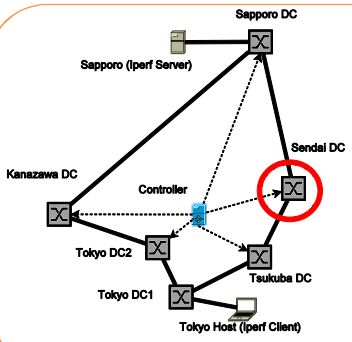




Method: Assuming all SDN/OpenFlow devices are deployed on SINET3, the number of controller is varied from one to four. All possible locations of controllers are investigated, and the optimal values are revealed. The details of latency metrics are in *.

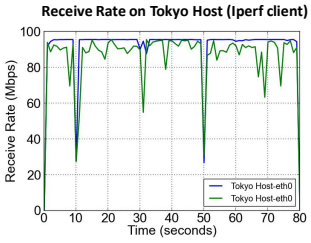
In term of latency, one controller is enough for the SINET3

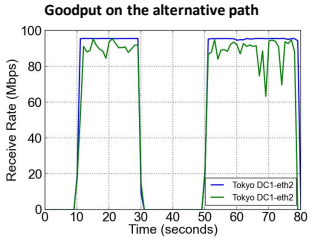
** Kien Nguyen, Quang Tran Minh, and Shigeki Yamada. "A Software-Defined Networking approach for Disaster-Resilient WANs", Proc. Of PMECT 2013 (accepted)).*



Example 2: We investigate reactive switch-over from a faulty link to an alternative link on a part of SINET3, assuming a realistic scenario

Method: We simulated the following disaster recovery scenario in SINET3. First, a TCP flow is generated over a path between Iperf server and client. Then an earthquake occurs, and the path is broken due to link failure. A controller finally sets up an alternative path for the TCP flow, using OpenFlow protocol.





Fast restoration of TCP traffic using SDN/OpenFlow technology

NII
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