vFiber: Virtualizing Unused Optical Fibers

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INTRODUCTION

Virtualization leads to increased utilization of the virtualized resource

Areas served have been: processors, storage, batteries, etc.

Still, fiber optical strands are underutilized

MOTIVATION

add physical network capacity on-demand

- **Fast movement of massive amounts of data**
- **New market and revenue stream for fiber optic providers**
- **A truly elastic and reconfigurable physical network**

Like spinning-up a new VM in the cloud, we are building a platform for users to spin-up unused optical fibers between endpoints.

Our system will reconfigure the physical network with new links providing additional capacity

WHY NOW?

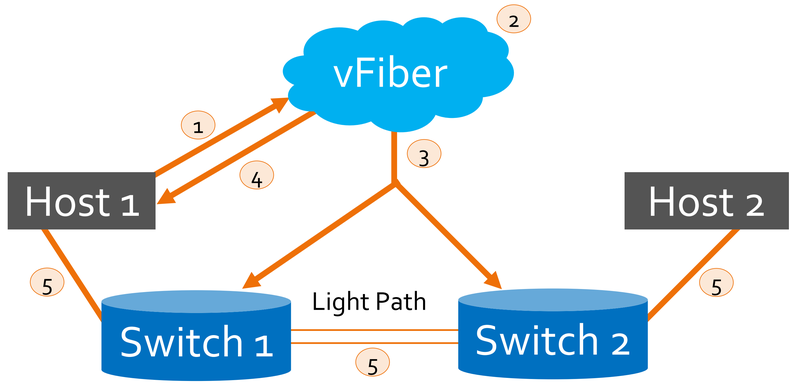
Current over-supply of buried dark fiber can be used to create a new fiber market [3, 4]

Todays fiber-optic hardware allows fast remote reconfigurations, i.e. milliseconds to provision an idle circuit [1,2,5]

CHALLENGES

- Many administrative Domains
- Wide Range of Operating Conditions
- Lack of Physical Layer Awareness
- Ensuring Transactional and Fault-Tolerant Behaviour

EXPERIMENTAL TEST BED

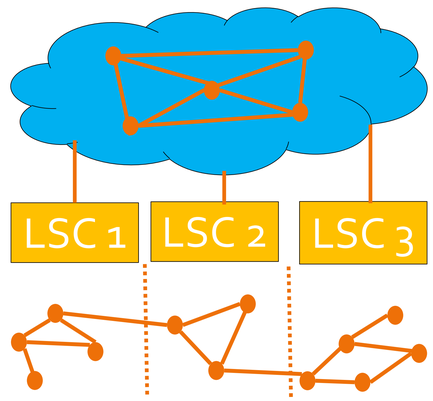


1. Host 1 requests a path to Host 2 from vFiber
2. vFiber conducts an auction for the requested path, and Host 1 wins
3. vFiber lights a path of optical fiber between Switch 1 and Switch 2 and permits access and QoS guarantees from Host 1 to Host 2
4. vFiber Sends connection information to Host 1
5. Host1 is free to connect with Host 2

The light path was dark. Then vFiber pushed new configuration commands and lit the path.

This results in an new network topology with increased capacity at Host 1's demand

vFIBER SYSTEM DESIGN



Distributed Global Controller (DGC)

Local Site Controller

Physical Topology

The DGC is made of of multiple redundant servers.

When a client wins a path through auction the DGC sends commands to LSCs who modify the physical topology.

When LSCs confirm successful path configuration, they inform the DGC

SYSTEM HIGHLIGHTS

vFiber is designed with scalability and reliability in mind by **distributing the system components and infrastructure** used.

Multi-link paths are configured through **atomic transaction**.

We are developing new testing capabilities for link installations to cope with a wide range of operating conditions

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