Network utilization with SDN in on-demand application-specific networks

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Internet factories

- Internet factories: Creating application-specific networks on-demand[1]
- Uses Infrastructure-as-a-Service clouds
- Create, configure and modify the infrastructure
- Second implementation Compute factory
Overlay networks

- A network built on top of one or more existing networks
- Add extra functionality
OSPF / SDN comparison

Open Shortest Path First (OSPF):
- Mature protocol
- Widely used and supported
- Uses Dijkstra’s algorithm
- Used by Compute factory

Software Defined Networking (SDN):
- Separation between control plane and data plane
- Centralized management
- Programmability
- Routing granularity
If the created overlay networks make use of SDN (OpenFlow), Compute factory’s control loops that observe and modify the behavior can gain benefits.
Related work

- SDN Based Load Balancing Mechanism for Elephant Flow in Data Center Networks[4]
Differences from our case

- Virtual Machine migration
- Connection speed
- Dynamic infrastructure
Elephants and Mice flows

- Elephant flow: Long-lived flow with large data transfer
- Mice flow: Short-lived flow with small data transfer
Compute factory

Amazon cloud

OpenFlow controller

Observe/Modify Flows

Floodlight

Compute factory

Observe/Modify Infrastructure

Create Configure

Created Topology

Switch 1

Switch 2

Switch 3

Switch 4

Switch 5

*All VMs use t1.micro instance type
Compute factory flow control loop

1. Get topology from the controller
2. Get statistics from the controller
3. Check network for congested links
4. Has the network congested links?
   - Yes: Check for solutions
   - No: Exist any solutions?
     - No: Wait some time
     - Yes: Push flows to the controller

Scenarios

First
Transfer sequential small and large file in empty path

Second
Transfer simultaneously small and large file with the Copmute factory control loop disabled

Third
Transfer simultaneously small and large file with the Copmute factory control loop enabled
Scenario results

Total time transferring a file

Mouse flows

- Empty path
- Control loop disabled
- Control loop enabled

Elephant flows

- Empty path
- Control loop disabled
- Control loop enabled

Mouse flows (1 MB)

Elephant flows (500 MB)
CPU utilization

CPU utilization in the intermediate switches
Conclusions

- Increase stability in data transfer
- Decrease jitter
- Balance the CPU load in intermediate switches
- Not increase network utilization
Thank you
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MiceTrap: Scalable Traffic Engineering of Datacenter Mice Flows using OpenFlow

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SDN Based Load Balancing Mechanism for Elephant Flow in Data Center Networks