Data Center Virtualization: Open vSwitch

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Slides from ACM SIGCOMM Workshop on Hot Topics in Networking (HotNets) presentation of “Extending networking into the virtualization layer”
Goals for Today

• Extending networking into the virtualization layer
Outline

• Motivation
• Design
• Applications
• Implementation
• Evaluation
• Discussion/Future Work
Motivation

• Virtualization is pervasive
  – At the time of writing in 2009:
    • 12% of workloads were virtual
    • Gartner predicted by 2013, 61% of workloads would be virtual
  – Scott Shenker’s talk: Virtual switches is more numerous than physical switches today
  – Intel: All endhosts should be virtualized
Networking in virtual environments is important

• Clouds routinely host 40, 60, 120 or more virtual hosts per physical host
  – 128VM’s per host is more than 2 racks full of machines
Networking in virtual environments is different

• Challenges
  – Scalability \((10^5\text{ VMs or much more})\)
  – Isolation
  – Mobility

• Conveniences
  – Hypervisor info
  – Introspection
  – Leaf nodes
Networking in virtual environments is different

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  – Isolation
  – Mobility

• Conveniences
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Motivation

Open vSwitch
  Distribute the Switch
  Centralize Control
  Take Advantage
Outline

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Open vSwitch

• Control Plane/Controller/OpenFlow
  – Configuration
  – Connectivity Management
    • creating switches, managing virtual interface (VIF) connectivity, and managing physical interface (PIF) connectivity
      – for each connected VIF, a logical port is added to the switch
  – Features
    • VLAN, Port Mirroring, ACLs, NetFlow, Bonding, QoS, Anything*

• Data Plane/Forwarding/OpenFlow
  – OpenFlow controller remotely controls forwarding table
  – Defines how packets handled based on L2, L3, L4 headers
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Distributed Switch

Logical View

VM 1

VM n

VM 2
Distributed Switch

Physical View
VM 1
VM 2
VM host 1
VM host k
VM n
Physical Switch

Logical View
VM 1
VM 2
VM n
GRE
Controller
Extending the Data Center into the Cloud

Managed Cloud

VM 1
VM 2
VM host 1
VM n
VM host k

“cloud access server”

Customer Data Center

Controller

Applications

GRE/IPSEC/SSL
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Evaluation

• Compare Open vSwitch to Linux Bridge

• Bandwidth
  – Fast Path: > 1Gbps
  – ovs-vswitchd: 100Mbps
  – Controller: 10Mbps

• Latency
  – Fast Path: < 1 us
  – ovs-vswitchd: < 1 ms
  – Controller: ms+
Evaluation

- Compare Open vSwitch to Linux Bridge

- Same performance as Linux bridge with same CPU
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Discussion/Future work

• Hardware acceleration in a virtual world?
  – Netronome, VN-Tag, VEPA

• Performance, performance, performance
• Physical switches integration
• Upstream kernel integration
• Anything*
Before Next time

- Project Interim report
  - Due Monday, November 24.
  - And meet with groups, TA, and professor
- Fractus Upgrade: Should be back online

**Required review and reading for Friday, November 21**

- Check piazza: http://piazza.com/cornell/fall2014/cs5413
- Check website for updated schedule