The Software Defined Datacenter

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Server Virtualization

- Hardware virtualization presents a complete x86 platform to the virtual machine
- Allows multiple applications to run in isolation within virtual machines on the same physical machine
- Virtualization provides direct access to the hardware resources to give you much greater performance than software emulation
Virtual Platform Evolution

- **2001-2005**: Server Virtualization
  - VMs, Physical Storage, Network and Security

- **2006-2010**: Cluster / Distributed Virtualization
  - Pools of compute, Physical Storage, Network, and Security

- **2011+**: Hybrid Cloud
  - Virtual DataCenters, Virtual Storage, Network, & Security
Past

$10,000
10 weeks

Present

$1,800
5 days, 2 minutes

Enterprise storage
VLAN networks
Firewall, load-balancer
IDS, security, monitoring
Availability
5 days, 2 minutes

3 minutes

VDC

Software-defined Datacenter Services
Software-defined Datacenter

Cloud
A way of offering computing services that prioritizes
- Self-service
- Elasticity
- Pay-by-use
- Agility

Software-defined Data Center
The architecture for cloud where:
- All infrastructure is virtualized
- Delivered as a service
- Control of this datacenter is entirely automated by software
SDDC Mantra

Abstract
Decouple from physical

Pool
Scale infinitely, manage as one

Automate
Provision/manage per app’s needs

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Software Defined Networking

Telephony
Identifier = Location

Networking
Identifier = Location

192.168.10.1

VM

192.168.10.1

VM

VM

ARISTA

BROCADE

CISCO

BROADCOM

EMULEX

VXLAN

650.555.1212

Wireless Telephony

650.555.1212

192.168.10.1
Low Latency Requirements

Guest OS

Virtual Infrastructure
Virtual Infrastructure RDMA

- Distributed services within the platform, e.g.
  - vMotion (live migration)
  - Inter-VM state mirroring for fault tolerance
  - Virtually shared, DAS-based storage fabric

- All would benefit from:
  - Decreased latency
  - Increased bandwidth
  - CPU offload
Guest OS RDMA

- RDMA access from within a virtual machine
- Scale-out middleware and applications increasingly important in the Enterprise
  - memcached, redis, Cassandra, mongoDB, …
  - GemFire Data Fabric, Oracle RAC, IBM pureScale, …
- Big Data an important emerging workload
  - Hadoop, Hive, Pig, etc.
- And, increasingly, HPC
SDN and RDMA

• SDN
  – Decouple logical network from physical hardware
    • Encapsulate Ethernet in IP → more layers
  – Flexibility and agility are primary goals

• RDMA
  – Directly access physical hardware
    • Map hardware directly into userspace → fewer layers
  – Performance is primary goal

• Is there any hope combining the two?
  – Converged datacenter supporting both SDN management and decoupling along with RDMA
Glimmers of Hope

• While 50+% of datacenter workloads are now virtualized, many customers have a mix of virtual and physical hardware
  – while percentage will continue to increase, there are some workloads that will likely remain un-virtualized

• The need for low-latency, high-bandwidth interconnect in the enterprise is a clear trend
  – e.g., scale-out DBMS, Big Data, etc.

► SDDC (and SDN) must accommodate these realities in the future datacenter
More (Philosophical) Glimmers

• SDN splits the control and data planes and uses a centralized controller to program switch fabric
  – Central fabric management familiar to RDMA community

• SDN exploring use of more physical telemetry to offer better application performance (while still maintaining network abstraction)
  – Metrics, topology sensing

• SDDC wants to treat datacenters as pools of interchangeable resources – all traffic becomes East/West – driving datacenters towards high bisection and low, uniform latency topologies
RoCE Thought Experiment

• Can RoCE be used as the basis of an SDN environment that also supports RDMA?
• RoCE satisfies both of SDN’s basic requirements
  – IP connectivity to all hosts – needed by management controller
  – IP for Ethernet encapsulation
• Hypervisor-Hypervisor traffic
  – Support both IP and RDMA traffic
  – Use of RDMA to accelerate virtual-platform services, e.g. live migration
RoCE Thought Experiment (2)

• VM-VM traffic
  – IP connectivity available
  – RDMA via passthrough, or
  – Paravirtualized RDMA (for endpoint mobility)

• Simultaneous sharing of interconnect for:
  HV-HV / VM-VM / IP / RDMA

• Visibility of RDMA traffic to SDN framework?
• RoCE approach seems to support what is necessary for SDN management and data paths while also allowing hosts and VMs to access RDMA, as required
• IPoIB? Perhaps a similar answer…
Summary

• Software Defined Datacenter is a critical component for delivering the full value of cloud computing
• SDN is the means by which networking will be decoupled from underlying hardware
• RDMA is clearly important for the future Enterprise datacenter
• We would value discussions with experts to craft a solution that supports RDMA within a larger SDDC/SDN context
Thank You