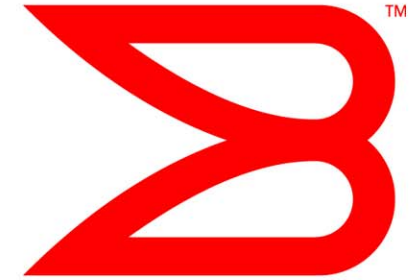**BROCADE**

Bridge Requirements for Server Virtualization

new-dcb-ghanwani-server-virtualization-0908-v1

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Motivation

- Many data center customers are in various stages of evaluating or deploying server virtualization; VMware, Microsoft Virtual Server
  - Increases server CPU utilization especially as multi-core CPUs are introduced
  - Changes admin ratios – from 20-30 servers/admin for physical machines to 60-100 servers/admin for virtual machines
- The market for virtual machine software is growing rapidly [IDC]
  - $1.78B in 2007 from $1.05B in 2006
  - $5.5B by 2012
- This introduces some new problems in the area of networking for virtualized server entities

Definitions

- VM: Virtual Machine
    - An instantiation of a server within a physical machine
    - Does everything that regular servers do
    - Communication channel to the external world is shared with other VMs
    - May communicate with other VMs within the same machine
    - May or may not be under the administrative control of the entity managing the physical machine in which it is instantiated
    - The OS running in the VM is sometimes referred to as a "guest OS"
- Hypervisor
    - Performs administrative functions for managing the virtualized environment
        - e.g. VMs register with the hypervisor when instantiated
    - Implements inter-VM communication (when that communication is implemented in software), sometimes called a "soft switch"
    - Under administrative control of the entity managing the physical machine

Problems that need to be addressed (1)

- Performance/scalability
  - Implementing the communication path between VMs in software uses precious CPU cycles
  - Software-based solution is not cost effective as we get to 10G and beyond
- Security
  - Authentication of the VMs and the hypervisor
  - Guard against VM (guest OS) spoofing a MAC address
  - What assumptions can be made about the integrity of frame contents coming from a VM?
    - Inside the physical machine/on the NIC
   - Outside the physical machine in an external bridge

Problems that need to be addressed (2)

- Manageability
  - Does the communication entity function as a piece of the server or of the network?
  - Can security features be implemented inside the server or outside?
  - Dealing with resource mobility in a seamless fashion – A VM moving from one physical machine to another
  - How to control the proliferation of bridges that need to be managed?
    - As many bridges as there are servers!

- Traffic management
  - Multiple VMs share the same physical channel to the external bridge
  - Dedicated CN/PFC/ETS per VM?
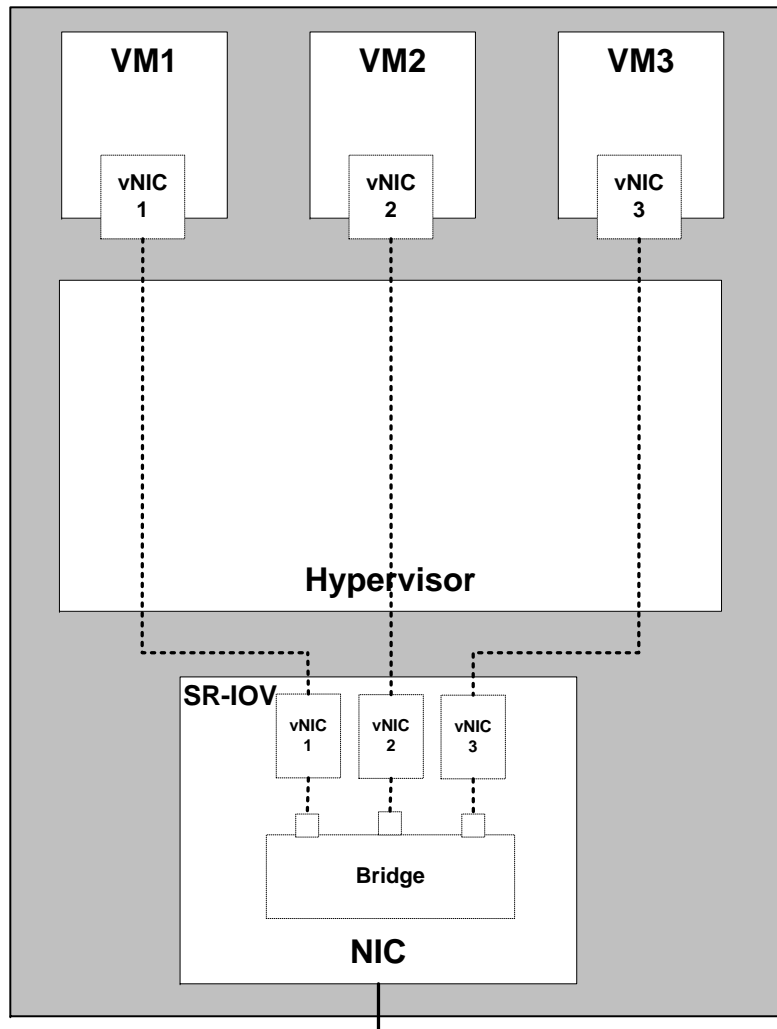
Implementation options
Software-based implementation in the hypervisor
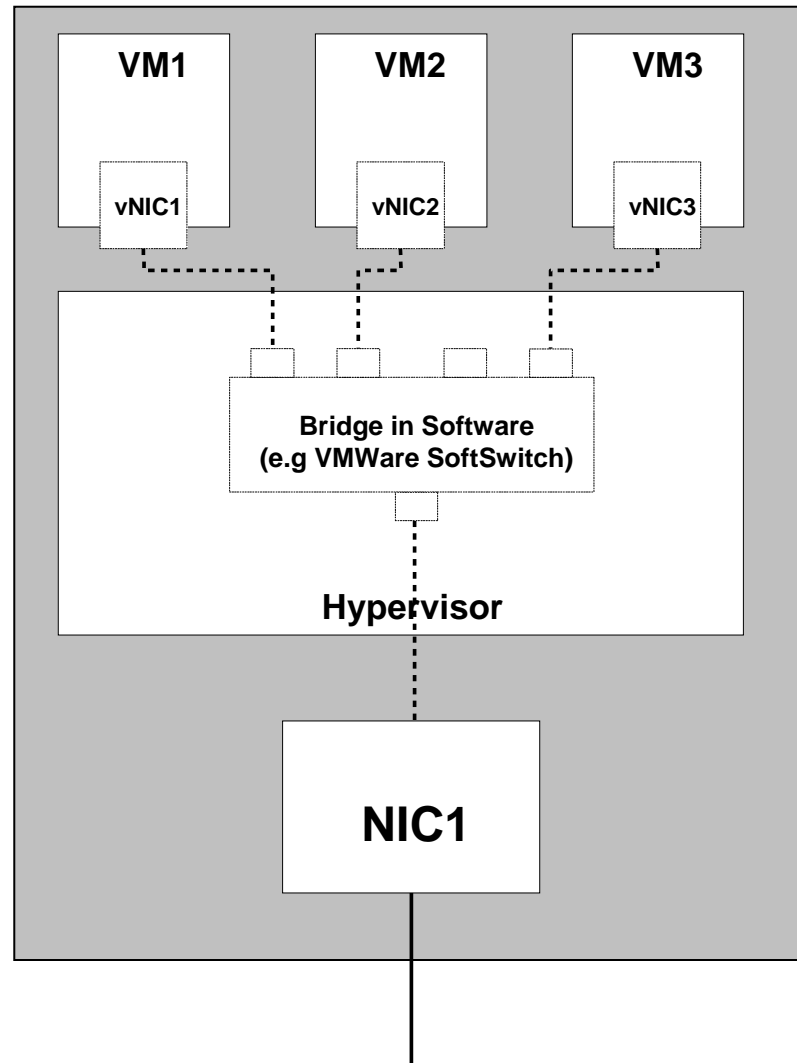
- This is how it's done today
- Implementation of regular expression ACLs would be too much of a performance hit

Implementation options
Inside the physical machine/server

+ No changes to on-the-wire frame formats

+ Easier to implement things like per-VM traffic management

- Requires the NIC implementer to build a switch, and possibly all the security components that go with it – increases cost and complexity

- Potential scaling issues with respect to number of VMs that can be supported

- Management could a problem – server guys and switch guys are usually independent

Implementation options
In an external bridge
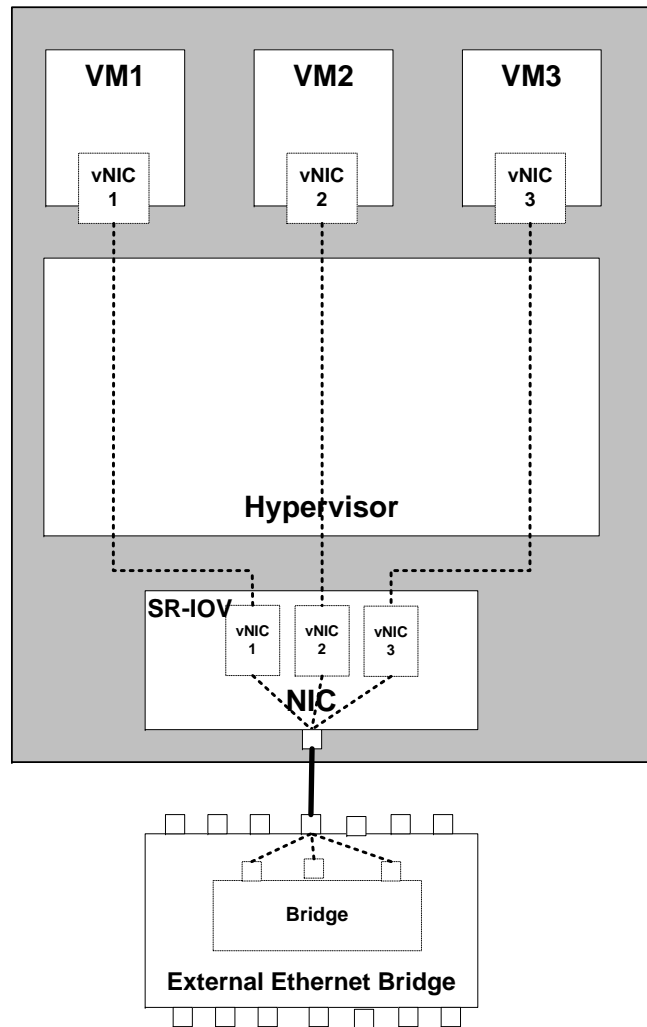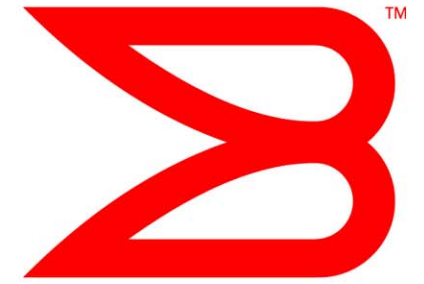

+ Most of the functionality already exists

+ Allows centralized management

? May or may not need changes to on-the-wire frame format depending on what fields in the existing frame can be trusted

- Potential scaling issues with respect to bandwidth
  – Frames must go to an external device only to be bridged back out the same port
  – How to handle frames that need to be multicast to VMs within the same physical machine?

- Implementing per-VM traffic management could be tricky

Implementation options
Combined server and external switch

- Best of both?

- Traffic mgmt in the adapter

- Administrative controls in the external bridge

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THANK YOU