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# (54) SYSTEM AND METHOD FOR PROVIDING A SCALABLE SIGNALING MECHANISM FOR VIRTUAL MACHINE MIGRATION IN A MIDDLEWARE MACHINE ENVIRONMENT

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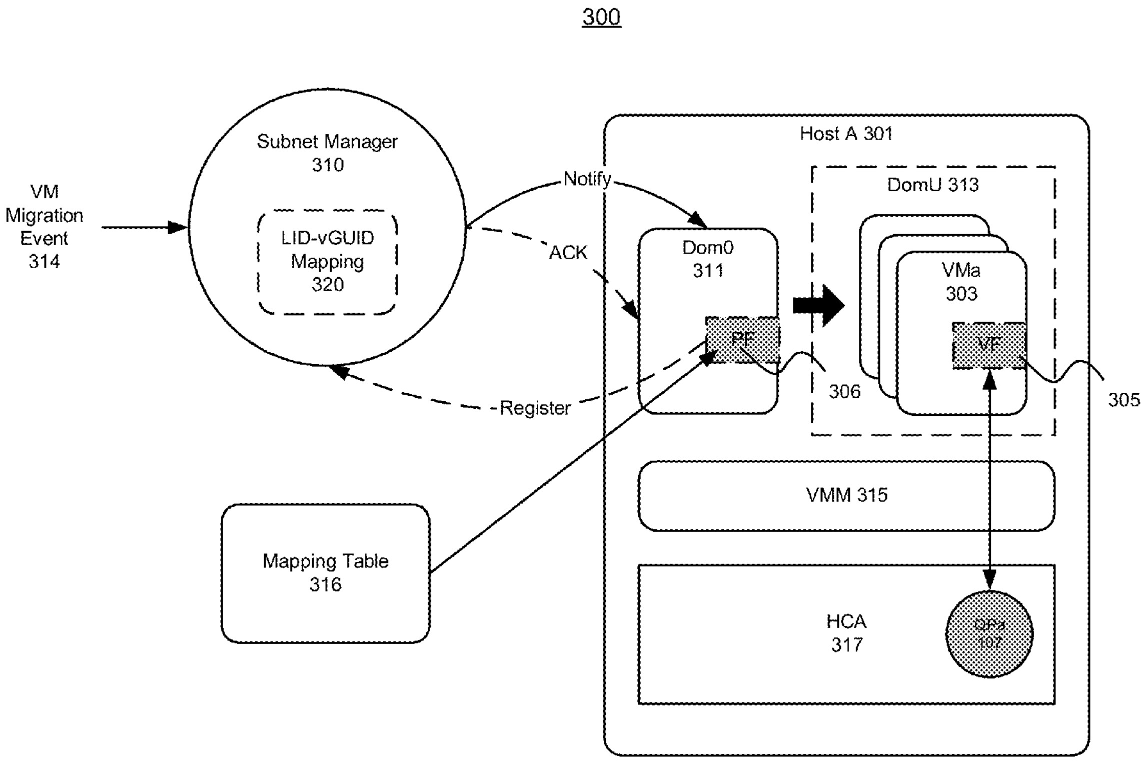
## (57) ABSTRACT

A system and method can support a signaling method in a virtualization environment. The management domain on one or more physical servers can be provided with a mapping table. The management domain operates to receive a message from the subnet administrator, wherein the message indicates a path record change event, such as a virtual machine (VM) migration event in the network. Then, the management domain can forward the received message to one or more virtual machine associated with the management domain based on the mapping table.



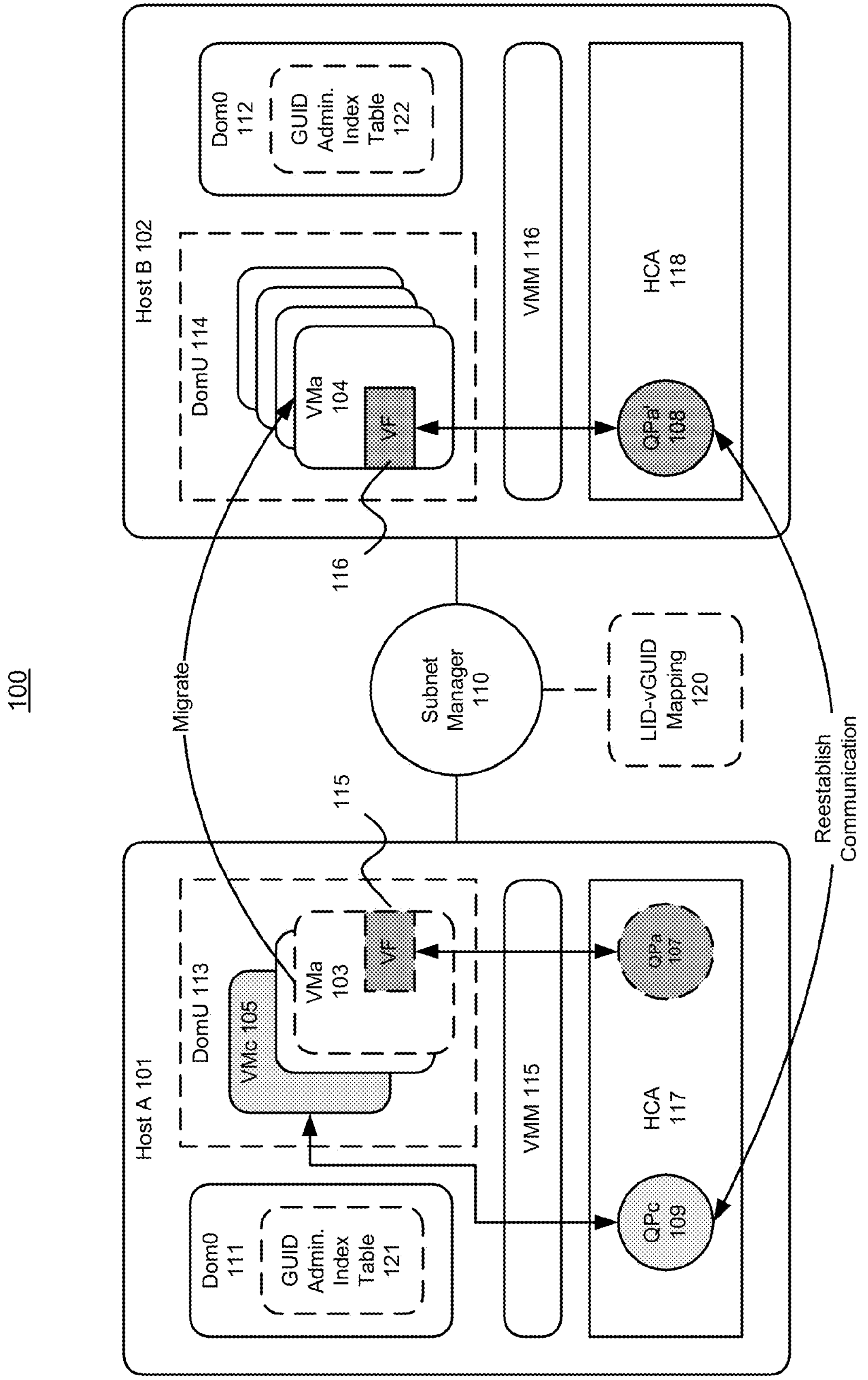

100
Host A 101
Dom0
111
GUID
Admin.
Index
Table
121
DomU 113
VMc 105
VMa
103
VF
115
VMM 115
HCA
117
QPc
109
QPa
107
Migrate
Subnet
Manager
110
LID-vGUID
Mapping
120
116
Reestablish
Communication
Host B 102
DomU 114
VMa
104
VF
VMM 116
HCA
118
QPa
108
Dom0
112
GUID
Admin.
Index
Table
122

*FIGURE 1*

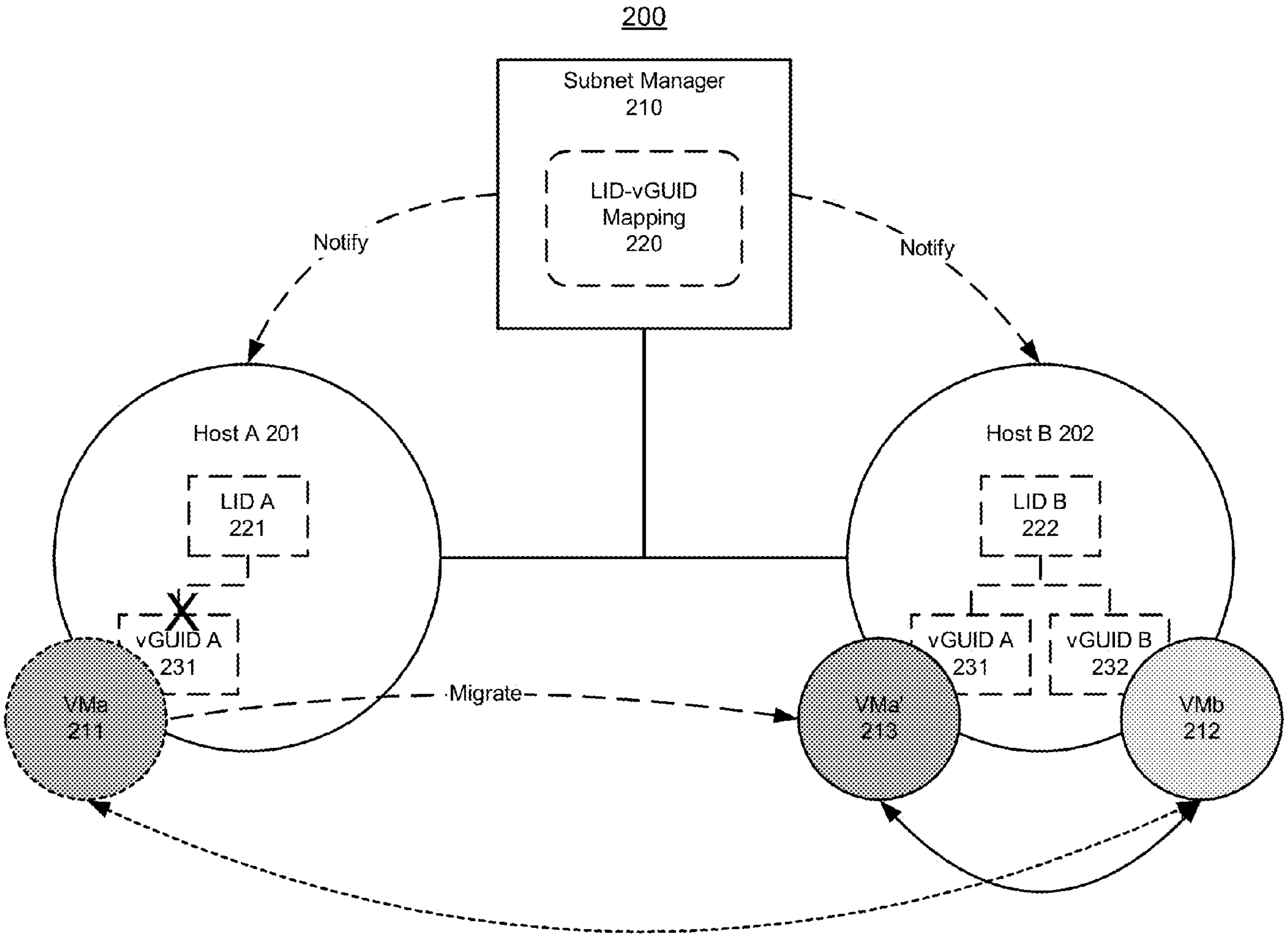

200
Subnet Manager
210
LID-vGUID
Mapping
220
Notify
Notify
Host A 201
LID A
221
vGUID A
231
VMa
211
Migrate
Host B 202
LID B
222
vGUID A
231
vGUID B
232
VMa'
213
VMb
212

*FIGURE 2*

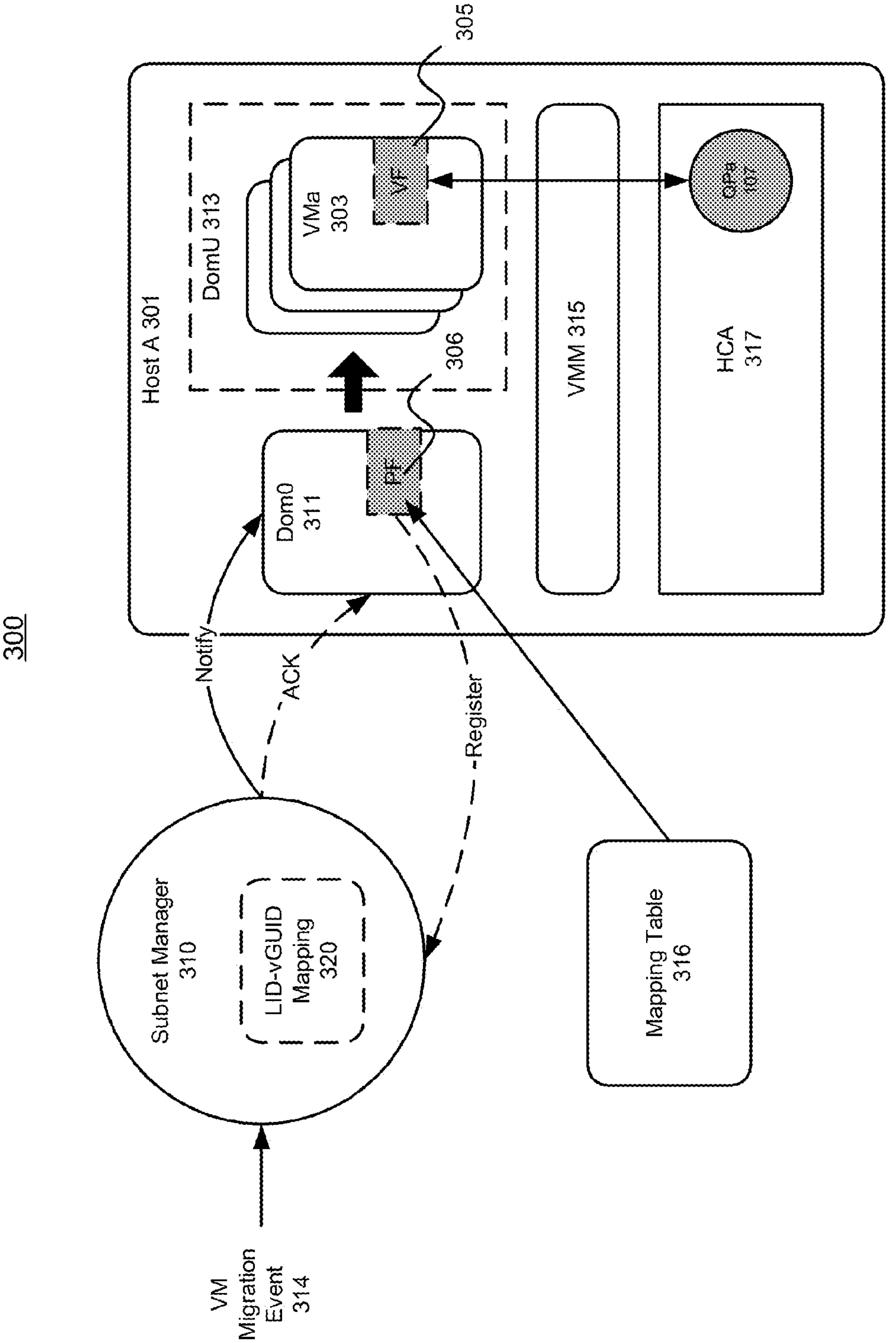

300
Host A 301
DomU 313
VMa
303
VF
305
306
Dom0
311
PF
VMM 315
HCA
317
QPs
107
Notify
ACK
Register
Subnet Manager
310
LID-vGUID
Mapping
320
Mapping Table
316
VM
Migration
Event
314

*FIGURE 3*

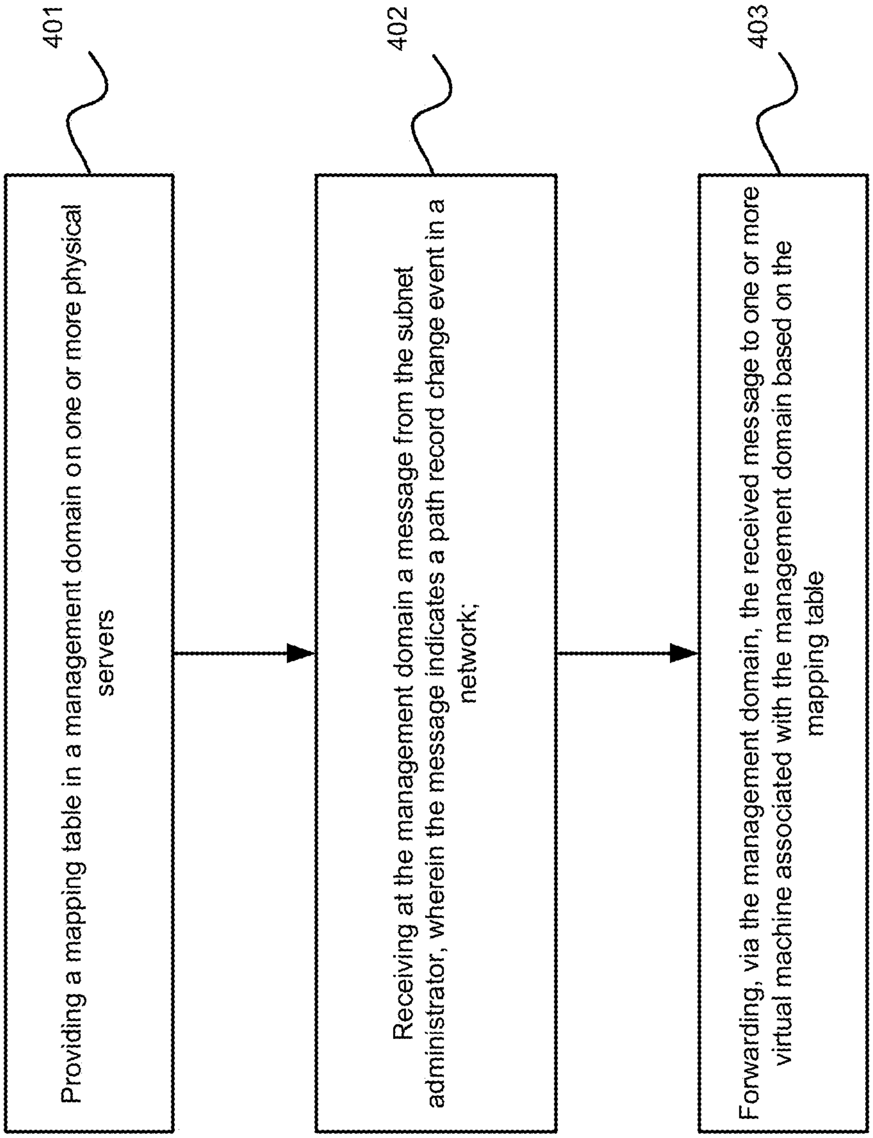

401
Providing a mapping table in a management domain on one or more physical servers
402
Receiving at the management domain a message from the subnet administrator, wherein the message indicates a path record change event in a network;
403
Forwarding, via the management domain, the received message to one or more virtual machine associated with the management domain based on the mapping table

FIGURE 4

# SYSTEM AND METHOD FOR PROVIDING A SCALABLE SIGNALING MECHANISM FOR VIRTUAL MACHINE MIGRATION IN A MIDDLEWARE MACHINE ENVIRONMENT

## CLAIM OF PRIORITY

**[0001]** This application claims priority on U.S. Provisional Patent Application No. 61/615,731, entitled "SYSTEM AND METHOD FOR SUPPORTING LIVE MIGRATION OF VIRTUAL MACHINES THAT USE RDMA BASED COMMUNICATION" filed Mar. 26, 2012, and U.S. Provisional Patent Application No. 61/693,703, entitled "SYSTEM AND METHOD FOR PROVIDING A SCALABLE SIGNALING MECHANISM FOR VIRTUAL MACHINE MIGRATION IN A MIDDLEWARE MACHINE ENVIRONMENT" filed Aug. 27, 2012, which applications are herein incorporated by reference.

## CROSS REFERENCE TO RELATED APPLICATIONS

**[0002]** This application is related to the following patent applications, each of which is hereby incorporated by reference in its entirety:

**[0003]** U.S. patent application titled "SYSTEM AND METHOD FOR SUPPORTING LIVE MIGRATION OF VIRTUAL MACHINES IN AN INFINIBAND NETWORK", application Ser. No. ______, filed ______, 2013 (Attorney Docket No. ORACL-05351US1);

**[0004]** U.S. patent application titled "SYSTEM AND METHOD FOR SUPPORTING LIVE MIGRATION OF VIRTUAL MACHINES IN A VIRTULIZATION ENVIRONMENT", application Ser. No. ______, filed ______, 2013 (Attorney Docket No. ORACL-05351US2); and

**[0005]** U.S. patent application titled "SYSTEM AND METHOD FOR SUPPORTING LIVE MIGRATION OF VIRTUAL MACHINES BASED ON AN EXTENDED HOST CHANNEL ADAPTOR (HCA) MODEL", application Ser. No. ______, filed ______, 2013 (Attorney Docket No. ORACL-05351US3).

## FIELD OF INVENTION

**[0006]** The present invention is generally related to computer systems, and is particularly related to supporting computer system virtualization.

## BACKGROUND

**[0007]** As larger cloud computing architectures are introduced, the performance and administrative bottlenecks associated with the traditional network and storage have become a significant problem. The InfiniBand (IB) technology has seen increased deployment as the foundation for a cloud computing fabric. This is the general area that embodiments of the invention are intended to address.

## SUMMARY

**[0008]** Described herein are systems and methods that can support a signaling method in a virtualization environment. The management domain on one or more physical servers can be provided with a mapping table. The management domain operates to receive a message from the subnet administrator, wherein the message indicates a path record change event, such as a virtual machine (VM) migration event in the network. Then, the management domain can forward the received message to one or more virtual machine associated with the management domain based on the mapping table.

## BRIEF DESCRIPTION OF THE FIGURES

**[0009]** FIG. **1** shows an illustration of the live migration of a virtual machine in a virtualization environment, in accordance with an embodiment of the invention.

**[0010]** FIG. **2** shows an illustration of supporting a signaling method in a virtualization environment, in accordance with an embodiment of the invention.

**[0011]** FIG. **3** shows an illustration of implementing a signaling method in a virtualization environment, in accordance with an embodiment of the invention.

**[0012]** FIG. **4** illustrates an exemplary flow chart for supporting the live migration of a virtual machine in a virtualization environment, in accordance with an embodiment of the invention.

## DETAILED DESCRIPTION

**[0013]** The invention is illustrated, by way of example and not by way of limitation, in the figures of the accompanying drawings in which like references indicate similar elements. It should be noted that references to "an" or "one" or "some" embodiment(s) in this disclosure are not necessarily to the same embodiment, and such references mean at least one.

**[0014]** The description of the invention as following uses the Infiniband (IB) network as an example for a high performance network. It will be apparent to those skilled in the art that other types of high performance networks can be used without limitation. Also, the description of the invention as following uses the Xen virtualization model as an example for a virtualization model. It will be apparent to those skilled in the art that other types of virtualization models can be used without limitation.

**[0015]** Described herein are systems and methods that can support virtual machine (VM) live migration in a network.

**[0016]** In accordance with an embodiment of the invention, virtualization can be beneficial to efficient resource utilization and elastic resource allocation in cloud computing. Live migration makes it possible to optimize resource usage by moving virtual machines (VMs) between physical servers in an application transparent manner. Thus, virtualization can enable consolidation, on-demand provisioning of resources, and elasticity through live migration.

### InfiniBand (IB) Architecture

**[0017]** The IB Architecture is a serial point-to-point full-duplex technology. The IB networks can be referred to as subnets, wherein a subnet consists of a set of hosts interconnected using switches and point-to-point links. An IB subnet can include at least one subnet manager (SM), which is responsible for initializing and bringing up the network, including the configuration of all the switches, routers and host channel adaptors (HCAs) in the subnet.

**[0018]** IB supports a rich set of transport services in order to provide both remote direct memory access (RDMA) and traditional send/receive semantics. Independent of the transport service used, the IB HCAs communicate using queue pairs (QPs). A QP is created during the communication setup, and can have a set of initial attributes such as QP number, HCA port, destination LID, queue sizes, and transport service that are supplied. An HCA can handle many QPs, each QP consists of a pair of queues, such as a send queue (SQ) and a receive queue (RQ), and there is one such pair present at each end-node participating in the communication. The send queue holds work requests to be transferred to the remote node, while the receive queue holds information on what to do with the data received from the remote node. In addition to the QPs, each HCA has one or more completion queues (CQs) that are associated with a set of send and receive queues. The CQ holds completion notifications for the work requests posted to the send and receive queue. Even though the complexities of the communication are hidden from the user, the QP state information is kept in the HCA.

## Input/Output (I/O) Virtualization

**[0019]** I/O Virtualization (IOV) can provide availability of I/O by allowing VMs to access the underlying physical resources. The combination of storage traffic and inter-server communication impose an increased load that may overwhelm the I/O resources of a single server, leading to backlogs and idle processors as they are waiting for data. With the increase in number of I/O requests, IOV can provide availability; and can improve performance, scalability and flexibility of the (virtualized) I/O resources to match the level of performance seen in modern CPU virtualization.

**[0020]** There can be different types of IOV technologies, such as emulation, paravirtualization, direct assignment (DA), and single root-I/O virtualization (SR-IOV). Among these IOV technologies, SR-IOV can extend the PCI Express (PCIe) specification with the means to allow direct access to a single physical device from multiple VMs while maintaining near to native performance. Thus, SR-IOV can provide good performance and scalability.

**[0021]** SR-IOV allows a PCIe device to expose multiple virtual devices that can be shared between multiple guests by allocating one virtual device to each guest. Each SR-IOV device has at least one physical function (PF) and one or more associated virtual functions (VF). A PF is a normal PCIe function controlled by the virtual machine monitor (VMM), or hypervisor, whereas a VF is a light-weight PCIe function. Each VF has its own base address (BAR) and is assigned with a unique requester ID that enables I/O memory management unit (IOMMU) to differentiate between the traffic streams to/from different VFs. The IOMMU also apply memory and interrupt translations between the PF and the VFs.

**[0022]** There can be different types of SR-IOV models, e.g. a shared port model and a virtual switch model. In the shared port model, all the VFs can share a single port address and a single QP name space, and only a single HCA port is exposed to the network. In the virtual switch model, each VF is a virtual HCA that contains a unique port address and a unique QP name space, and one HCA for each VF on the device is exposed to the network. Thus, the virtual switch model can simplify IOV with more complex hardware.

**[0023]** The use of an SR-IOV capable device can yield near native performance and improved scalability. On the other hand, SR-IOV may not be fully incompatible with live migration and check-point/restart mechanisms.

## Hardware Address Assignment and Virtual Machine (VM) Live Migration

**[0024]** In accordance with an embodiment of the invention, each physical IB device can be assigned with two addresses: a local identifier (LID), which can be used to route IB packets within a subnet, and a globally unique identifier (GUID), which can be used to route IB packets between different subnets. Furthermore, the GUID is the hardware address that can uniquely represent a physical IB device in an IB network.

**[0025]** In the shared port model, which is used to implement SR-IOV for an IB network, each VF can have its own virtual GUID (vGUID) and can share the LID with the PF on the physical server. Here, each virtual GUID (vGUID) is a hardware address that can uniquely represent a VF.

**[0026]** FIG. **1** shows an illustration of the live migration of a virtual machine in a virtualization environment, in accordance with an embodiment of the invention. As shown in FIG. **1**, an IB network **100** can include a subnet manager (SM) **110**, and a plurality of hosts, e.g. hosts A-B **101**-**102**.

**[0027]** Each host can include a VMM that uses a HCA and supports a management domain (or a privileged domain) that manages one or more virtual machines (VMs) in a user domain. As shown in FIG. **1**, host A **101** includes VMM A **115** that uses a HCA **117**, and VMM A **115** can support a Dom**0** **111** that manages DomU **113**. Also, host B **102** includes VMM B **116** that uses a HCA **118**, and VMM B **116** can support a Dom**0** **112** that manages DomU **114**.

**[0028]** In accordance with an embodiment of the invention, there can be a one-to-one relationship between a VM and a guest domain (i.e. DomU) in a virtualization model, such as the Xen model. Furthermore, the DomU, which is a resource container on the physical server that hosts a VM under the control of the VMM/Dom**0**, can be used to represent a Xen notion of a VM. Additionally, one-to-many, or many-to-one relationship may be existing between the VMs and the guest domains in other virtualization models without limitation. For example, a guest domain may be able to host different VMs.

**[0029]** A VM, e.g. VMa **103** can migrate from a host, e.g. host A **101**, to another host, e.g. host B **102** (as VMa **104**). Before the migration, VMa **103** can be attached with a VF, e.g. VF **115**, which is connected to a queue pair, e.g. QPa **107**. Additionally, VMa **103** can be in communication with VMc **105** that is associated with QPc **109**. After the migration, VMa **104** can be attached with a new VF, e.g. VF **116**, which is connected to a queue pair, e.g. QPa' **109**, that can reestablish the communication with QPc **109**.

**[0030]** In accordance with an embodiment of the invention, different hardware address assignment models can be used to assign vGUID for a VF, e.g. VF **115**.

**[0031]** In one example, the subnet manager (SM) **110** can use a dynamic assignment model to assign the vGUID for VF **115**, in addition to assigning the LID and GUID for the PF on Dom**0** **111**. The dynamic assignment model is similar to how addresses are assigned in the native IB.

**[0032]** During the subnet initialization, the PF on Dom**0** **111** can query the SM **110** for the vGUIDs that may be allocated to it's VFs, such as VF**115**. Accordingly, the SM **110** can generate the corresponding vGUIDs and can respond to the requesting PF. Then, the PF can store the received vGUIDs in the GUID administration index table **121** in Dom**0** **111**, with each VF associated with an appointed index in the GUID administration index table **121**.

**[0033]** Using the dynamic assignment model, the relation between an assigned VF and a VM is not constant. As shown in FIG. **1**, after the migration of VMa **103** from host A **101** to host B**102**, a new VF **116** from the destination server, i.e. host B **102**, can be assigned to the VMa **104**. As a result, the vGUID associated with VMa **104** changes because it is obtained from the GUID administration index table **122** in Dom**0** **112** of the host B **102**.

**[0034]** The dynamic assignment model is simple, because it uses the SM **110** to assign the addresses for both the VF and the PF. On the other hand, the vGUID associated with the VMa **103** may not be preserved after VM migration. Then, a query to the subnet administrator (SA) (e.g. on the subnet manager (SM) **110**) may need to be performed after VM migration in order to obtain the path information for the new vGUID. If the vGUID is not fixed for the VM, it may also be necessary to rediscover the vGUID currently used by a remote VM before path information can be obtained from the SA. Such mapping may include using address resolution protocol (ARP) operations where the hardware address associated with an IP address can be determined. These operations may introduce additional latency in bringing up the IB VF. Especially, this delay may increase the total service downtime when live migration is performed.

**[0035]** In another example, the subnet manager (SM) **110** can use a static assignment model to assign a vGUID for VF **115**. The static assignment model, which can preserve the vGUID that is assigned to a VM regardless of location, is more complex and is different from the native IB address assignment. In order to have a static vGUID throughout the VM life cycle, the static assignment model can be based on the SM **110**, or on a combination of the SM and the privileged domain (dom**0**). (The approach combining the SM and dom**0** is a preferred solution, since excessive management messages may be generated when only using the SM to maintain a static vGUID.)

**[0036]** Using the static assignment model, when a VM, e.g. VMa **103** is instantiated, it is assigned with a vGUID that is kept as part of the VM configuration. When a VF, e.g. VF **115**, is attached to the VMa **103**, the Dom**0** **113** can read the vGUID from the VM configuration and writes the vGUID to the GUID administration index table **121**. This event can also trigger a management message for updating the SM **110** with the latest vGUID to LID mapping **120**.

**[0037]** After the migration of VMa **103** from host A **101** to host B**102**, the attached VF **116** of the VMa **104** can preserve the vGUID that is associated with the attached VF **115** of the VMa **103**.

**[0038]** In accordance with an embodiment of the invention, the static assignment model may need further enhancement in order to support the VM live migration. As shown in FIG. **1**, VMc **105**, which is a communication peer of the migrated VMa **103**, may not be aware of the change in the LID to vGUID mapping. VMc **105** may continue to communication with the migrated VMa **103** using its outdated cached path information. As a result, the peers may fail to reach the migrated VMa **104** at the new location.

**[0039]** This is because the new VF **116**, from the destination server with a different LID, is attached to the migrated VMa **104**, even through the vGUID associated with the migrated VMa **104** remains the same. Additionally, VMc **105** may not be notified the updated path information, even though the SM **110** and the migrated VMa **104** have the updated LID to vGUID pair. Thus, the migrated VM peers may fail to reach the migrated VM, since the cached LID to vGUID pair in the migrated peers that was established earlier has become invalid.

Signaling Mechanism

**[0040]** In accordance with an embodiment of the invention, a signaling mechanism that maintains the network connectivity after VM migration can be implemented. Furthermore, the signaling method can be optimized so that a same event may only be forwarded once to a physical server regardless of the hosted VMs, in order to reduce the management message overhead.

**[0041]** FIG. **2** shows an illustration of supporting a signaling method in a virtualization environment, in accordance with an embodiment of the invention. As shown in FIG. **2**, an IB network **200** can include a subnet manager (SM) **210**, and a plurality of hosts, e.g. hosts A-B **201**-**202**. A VM, e.g. VMa **211**, which is in communication with a peer VMb **212**, can migrate from a host, e.g. host A **201**, to another host, e.g. host B **202** (as VMa' **213**).

**[0042]** As shown in FIG. **2**, before the live migration, VMa **211** can be assigned with a vGUID A **231**, and shares a LID A **221** with other VMs on host A **201**. The SM **210** can maintain such a relationship as an entry in the LID-vGUID mapping table **220**.

**[0043]** Using the static assignment model, after the live migration of the VMa **211**, VMa' **213** can preserve the vGUID A **231** and shares a different LID B **222** with other VMs on host B **202**. A repath/unpath notice can be used to update the LID/vGUID mapping **220** in the SM **210**, e.g. at the SA agent cache. The SM **210** can detect such change or event in the IB network **200** and can update the LID-vGUID mapping table accordingly.

**[0044]** Furthermore, the SM **210** can notify the communication peers about the updated path information. For example, the SM **210** can notify VMb **212** on host B about the migration of VMa **211**, and the change in the LID-vGUID mapping **220**, using repath/unpath notices.

**[0045]** FIG. **3** shows an illustration of implementing a signaling method in a virtualization environment, in accordance with an embodiment of the invention. As shown in FIG. **3**, an IB network **300** can include a subnet manager (SM) **310**, and a host A **301**, which includes a virtual machine monitor (VMM) **315** and a host channel adaptor (HCA) **317**. The VMM **315** can support a management domain (or a privileged domain), Dom**0** **311**, that manages one or more virtual machines (VMs) in a user domain, DomU **313**.

**[0046]** Furthermore, the system can configure all management datagram (MAD) traffic to be tunneled through a physical function (PF) associated with the management domain. As shown in FIG. **3**, a privilege domain, e.g. Dom**0** **311** on the host A **301**, which include includes a PF **306**, can support a plurality of virtual machines (VMs), e.g. VMa **303**. Additionally, the VMa **303** can be attached with a VF **305** that is associated with a QPa **307**. Additionally, VMa **303** can be in communication with a peer VM (not shown), which may be able to perform a live migration within the IB network **300** (as shown as a VM migration event **314**).

**[0047]** In accordance with an embodiment of the invention, the signaling method can include two phases: an event registration phase and an event forwarding phase.

**[0048]** In the event registration phase, each physical server can register for the repath event notification. As shown in FIG. **3**, the host A **301** can register with the subnet manager (SM) **310**, or a subnet administrator (SA), using its physical port GUID associated with its PF **306**. Then, the subnet manager

(SM) **310** can acknowledge (ACK) the physical server, i.e. the host A **301**, after the physical port GUID is registered successfully in the SM **310**.

**[0049]** The event forwarding phase can be performed when the VM migration happens **314**. The SM **310** can detect the changes in the LID-vGUID mapping **320** and notify all registered servers. For example, the SM **310** can signal a repath trap that has the latest LID-vGUID mapping, to all registered servers, including host A **301**. Then, the management domain, Dom**0 311**, on the host A **301** can forward the received notice to interested VMs, based on registered GUID in the mapping table **316**.

**[0050]** In order to avoid triggering the repath trap during a new VM creation or a VM reboot event (when the VM is shutdown and restarted at the same server), the following algorithm 1 can be used by the SM **310** to identify the changes in the LID to vGUID mapping **320**.

Algorithm 1 Trigger re-path trap with path record

```
if delete__guid(path__rec.guid) then
    add__to__trap__table(path__rec)
else if set__guid(path rec.guid) then
    if ret__rec=find__trap__table(path__rec.guid) then
        if ret rec.dlid != path__rec.dlid then
            construct__repath__notice(ret__rec)
            signal__repath__trap(notice)
        end if
        remove__from__trap__table(path__rec)
    end if
end if
```

**[0051]** When a vGUID is deleted from the SM **310** due to VM shutdown or VM migration, the path information can be added to a repath trap table, which is a temporary storage that can be used to differentiate between the VM creation event and the VM migration event. If a vGUID is already existed in the repath trap table when it is added to the SM **310**, the associated path information is compared with the entry in the repath trap table. If LID is different, this indicates that a VM migration has happened. Then, this newly added vGUID and its associated path information can be encapsulated in the repath trap, which can be signaled to all registered servers including host A **301**. Afterwards, the vGUID entry in the repath trap table can be removed.

**[0052]** In order to avoid creating a bottleneck in the SM **310**, the physical port GUID (i.e. the GUID for Dom**0 311** instead of the vGUID for VF **305**) can be used for event subscription with the SM **310**. Then, Dom**0 311** can be responsible for broadcasting the received notice to the VMs that it hosts.

**[0053]** The following algorithm 2 shows the implementation in Dom**0 311** to forward the received repath trap notice to the active VMs.

Algorithm 2 Forward the repath notice to VMs

```
if is__repath__trap__notice(notice) then
    for i = 0 to max__supported__VFs do
        if guid__cache[i] != NULL then
            ib__send__to__slave(notice)
        end if
    end for
end if
```

**[0054]** By only using the physical port GUID for event subscription, the generated management message (MMO) can be reduced.

**[0055]** Furthermore, the following algorithm 3 can be executed to reconfigure the cached path information, when the notice, which is forwarded by the Dom**0 311**, is received by each VM resided in a host.

Algorithm 3 Reconfigure the cached path record

```
if received repath trap notice(notice) then
    rec = get SAagent cache(notice.path rec.gid)
    if rec.dlid != notice.path rec.dlid then
        update SAagent cache(notice.path rec)
    end if
end if
```

**[0056]** For example, the host A **301** can extract its cached path information and compare them with the encapsulated path record in the repath trap. If there is a matched vGUID entry but with a different LID, the cached path information in the host stack can be updated.

**[0057]** Thus, the subnet manager (SM) **301** can track the complete life cycle of VMs based on the associated vGUID(s). For example, the subnet manager (SM) **301** can keep track of the current location of each VM and can notify relevant communication peers whenever a VM is being migrated and may need new address information using optimized hierarchical algorithms that reduces overhead and improves scaling.

**[0058]** Furthermore, other features, such as suspended state and migration states of a VM/vHCA, can be reflected to interested parties independently of whether the vGUID is currently associated with any fabric end-point or not.

**[0059]** FIG. **4** illustrates an exemplary flow chart for supporting the live migration of a virtual machine in a virtualization environment, in accordance with an embodiment of the invention. As shown in FIG. **4**, at step **401**, the system can provide a mapping table in a management domain on one or more physical servers. Then, at step **402**, the management domain can receive a message from the subnet administrator, wherein the message indicates a path record change event, such as a virtual machine (VM) migration event in the network. Furthermore, at step **403**, the management domain can forward the received message to one or more virtual machine associated with the management domain based on the mapping table

**[0060]** The present invention may be conveniently implemented using one or more conventional general purpose or specialized digital computer, computing device, machine, or microprocessor, including one or more processors, memory and/or computer readable storage media programmed according to the teachings of the present disclosure. Appropriate software coding can readily be prepared by skilled programmers based on the teachings of the present disclosure, as will be apparent to those skilled in the software art.

**[0061]** In some embodiments, the present invention includes a computer program product which is a storage medium or computer readable medium (media) having instructions stored thereon/in which can be used to program a computer to perform any of the processes of the present invention. The storage medium can include, but is not limited to, any type of disk including floppy disks, optical discs, DVD, CD-ROMs, microdrive, and magneto-optical disks, ROMs, RAMs, EPROMs, EEPROMs, DRAMs, VRAMs, flash memory devices, magnetic or optical cards, nanosystems (including molecular memory ICs), or any type of media or device suitable for storing instructions and/or data.

**[0062]** The foregoing description of the present invention has been provided for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Many modifications and variations will be apparent to the practitioner skilled in the art. The embodiments were chosen and described in order to best explain the principles of the invention and its practical application, thereby enabling others skilled in the art to understand the invention for various embodiments and with various modifications that are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the following claims and their equivalence.

What is claimed is:

**1**. A method for supporting a signaling method in a virtualization environment, comprising:

providing a mapping table in a management domain on one or more physical servers;

receiving at the management domain a message from a subnet administrator, wherein the message indicates a path record change event in a network; and

forwarding, via the management domain, the received message to one or more virtual machine associated with the management domain based on the mapping table.

**2**. The method according to claim **1**, further comprising:

subscribing to a subnet administrator for receiving notice on path record change.

**3**. The method according to claim **1**, further comprising:

updating the mapping table in the management domain when a user domain is added.

**4**. The method according to claim **1**, further comprising:

using repath/unpath notice to update the LID/vGUID mapping at the SA agent cache.

**5**. The method according to claim **1**, further comprising:

configuring all MAD traffic to be tunneled through a physical function (PF) associated with the management domain.

**6**. The method according to claim **1**, further comprising:

preserving the vGUID associated with a VM, after it migrates from a host to another host, wherein the VM is in communication with a peer VM.

**7**. The method according to claim **6**, further comprising:

forwarding a message that encapsulates a latest path record to the peer VM.

**8**. The method according to claim **1**, further comprising:

allowing each server to use their physical port GUID for the repath notification.

**9**. The method according to claim **1**, further comprising:

differentiating between a VM creation event and a VM migration event.

**10**. The system according to claim **9**, wherein:

assigning vGUID via a subnet manager.

**11**. A system for supporting a signaling method in a virtualization environment, comprising:

one or more microprocessors,

one or more physical servers running on the one or more microprocessors, wherein said one or more physical servers include a management domain provided with a mapping table, and wherein the management domain operates to

receive a message from a subnet administrator, wherein the message indicates a path record change event in a network; and

forward the received message to one or more virtual machine associated with the management domain based on the mapping table.

**12**. The system according to claim **11**, wherein:

said one or more physical servers operates to subscribe to a subnet administrator (SA) for receiving notice on path record change.

**13**. The system according to claim **11**, wherein:

said one or more physical servers operates to update the mapping table in the management domain when a user domain is added.

**14**. The system according to claim **11**, wherein:

said one or more physical servers operates to use repath/unpath notice to update the LID/vGUID mapping at the SA agent cache.

**15**. The system according to claim **11**, wherein:

said one or more physical servers operates to configure all MAD traffic to be tunneled through a physical function (PF) associated with the management domain.

**16**. The system according to claim **11**, wherein:

said one or more physical servers operates to preserve the vGUID associated with a VM, after it migrates from a host to another host, wherein the VM is in communication with a peer VM.

**17**. The system according to claim **16**, wherein:

a message that encapsulates a latest path record can be forwarded to the peer VM.

**18**. The system according to claim **11**, wherein:

each server can use their physical port GUID for the repath notification.

**19**. The system according to claim **11**, further comprising:

a subnet manager operates to differentiate between a VM creation event and a VM migration event.

**20**. A non-transitory machine readable storage medium having instructions stored thereon that when executed cause a system to perform the steps comprising:

providing a mapping table in a management domain on one or more physical servers;

receiving at the management domain a message from the subnet administrator, wherein the message indicates a path record change event in a network; and

forwarding, via the management domain, the received message to one or more virtual machine associated with the management domain based on the mapping table.

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