November 2023

LOCATION IDENTIFICATION FOR NETWORK DEVICES

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ABSTRACT

Information Technology (IT) managers and administrators often need to correlate the actual physical location of device (e.g., within a closet at address X, building 5, 2nd floor, east side) with an identity of the device that is shown within an IT management system. Such device identification is typically provided via device configuration or through the use of add-on "tags" that can be located on a device. However, many network devices or other types of "virtual constructs" (e.g., many devices acting as a single virtual box), particularly virtual systems can be located far apart from each other (e.g., across different floors, etc.). For example, two devices could be provided as a virtual system pair that is configured as "one device" within a management system, yet the physical location of each half of the system needs to be known. However, current IT management systems do not provide for identifying the actual location of each device of a virtual system, as the location configuration for the virtual system is a common configuration element for the virtual system itself. In order to address such issues, techniques are presented herein that provide for the ability to uniquely identify the physical location of each member of a virtual system.

DETAILED DESCRIPTION

In IT management systems, any physical hardware-based device can be tracked using its physical location. Many organizations use physical location to track devices for various purposes, such as for managing space, for locating equipment in case of failure, maintenance, replacement, or the like.

When a single physical hardware device used, it is easy to determine the location of the device. For example, a physical single network switch can be installed in a specific rack + room + floor + building with an identifiable location.

However, with the introduction of virtual or logical devices that can run on a single hardware device or multiple hardware devices, determining the location of virtual/logical devices has become more complex as it is often not straightforward to determine the physical location of such virtual/logical devices. It can be challenging to identify the physical location of virtual/logical devices because such devices can be spanned across multiple physical devices or can be running on one physical device at one time and can be moved to another physical device at a later time.

In some instances, such virtual/logical devices can change the location when underlying physical hardware is replaced or moved to another device. For example, an enterprise may utilize a switch implementation that combines multiple physical switches into a single logical entity. However, the physical switches can be in separate rack or separate room where physical location is not easy to determine based on the configured location of the overall logical switch.

In another example, a device may be implemented in a software-defined (SD) access network in a Layer 2 (L2) switch mode in which the physical location of the device is identified under the same site/location of a fabric edge device to which it is connected, which could be in a different location than the device operating in the L2 switch mode. It can be difficult to track the location of devices operating in such modes that are utilized in the SD-access network.

In these examples, there are best practices and methodologies to associate the location of the device either directly (e.g., through some configuration that describes where the device is located) or indirectly (e.g., this device is connected to another device from which the location can be derived).

However, there is currently no solution for configuring location for scenarios in which multiple physical devices are configured to appear as a single virtual/logical. As the physical devices forming this virtual device can be far apart (or in different floors), there is no mechanism through which to provide a configuration that identifies the location of the physical device peers, as there is no clear separation for virtual location and physical location of devices such that the configuration that is stored is for the virtual/logical device and not 'per physical device'.

Proposed herein is a technique to provide for the ability to track both physical location and virtual/logical location of devices within a nonvolatile configuration that can be provided for devices in which the configuration can include entries for both physical location and virtual/logical location of devices.

For example, consider a scenario in which a virtual switch consists of two physical switches in which one switch acts as an active management controller, but the other switch can be a standby management controller but all physical interfaces from both switches can operate as logical single switch. In this scenario, consider that one physical switch installed in Rack-1/Room-1/Floor-1 that defines the physical location of this logical switch and the second switch is installed in Rack-2/Room-2/Floor-1, as shown in Figure 1, below.

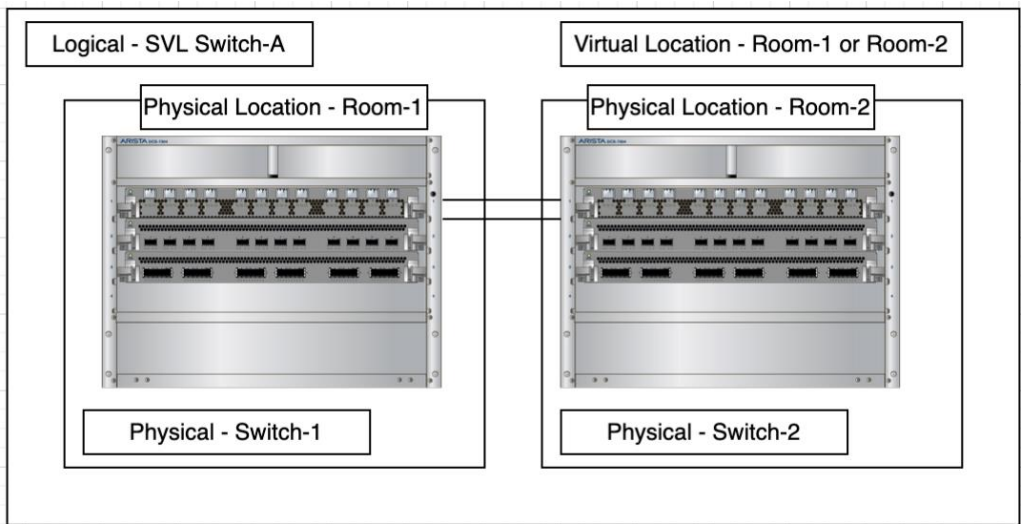

Figure 1: Example Scenario

In current deployments, the second switch can be only identified using one location configured in the switch / Simple Network Management Protocol (SNMP) location such that if there is change in the active/standby role of the two switches then the second switch would need a manual update or other changes to indicate a location change of the switch.

However, in accordance with techniques of this proposal, the nonvolatile configuration of the switches can be configured as follows:

Physical switch-1 location - SW1: Rack-1/Room-1/Floor-1

Physical switch-2 location - SW2: Rack-2/Room-2/Floor-1

System level logical location: Logical location mapped to Active physical switch location

By providing the above information in the nonvolatile configuration for each switch, the location information configured for each switch can still be mapped to a correct location for each switch whenever there is a change in the active/standby role of the switches, or a process is moved.

As an extension, similar information can be created for virtual machines, containers, application hosting, etc. for various use cases where physical location and logical location can be separated and tracked for various purposes, such as monitoring, configuring, assurance, hardware replacement, and/or the like.

Thus, as proposed herein, existing location information can be maintained in the manner that it is currently used in devices (for the case of virtual devices, the location represents the location of the logical device) and additional information can be added to the nonvolatile configuration of devices that identifies the physical location of devices, which can be individually updatable. For security purposes and to allow inadvertent moves, the physical location should be stored in the physical device (not only on the "previously active" device). The additional physical location information can be exported along with any other location information provided for a device.

Accordingly, proposed herein is a technique to provide location information of individual physical devices that may be part of a “cluster” or "virtual entity" or, as an extension, may provide for tracking any attribute of the physical devices that may form the cluster/virtual entity. Thus, techniques as presented herein can help in determining and providing a user with a physical location of logical/virtual devices as well as separately identifying the location of various physical devices that are part of the same logical/virtual devices, which may be useful for various activities, such as monitoring, hardware replacement, or the like.