

Best Practices: Modeling Virtual Environments in SPECTRUM

JANUARY 2009

Roger Nason

CA SPECTRUM SUPPORT

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Executive Summary

Challenge

Virtualization is a well established technology within the industry. While management of virtual environments is planned for future releases of SPECTRUM, many customers are using the technology today. In addition, the initial SPECTRUM solution will be focused specifically on virtual environments utilizing VMware. An interim management solution is required to support these valuable customers that are using other virtualization technologies such as Solaris Zones.

Opportunity

This paper discusses the best practices associated with modeling virtual environments using CA's SPECTRUM NETWORK FAULT MANAGER. Customers must be able to model these environments such that they can take advantage of SPECTRUM's management and fault isolation features. In addition, this document will briefly discuss the management that will ultimately be provided in future releases of the SPECTRUM product.

Benefits

Sound modeling practices will ensure that the most can be made out of the following SPECTRUM features:

- Fault Isolation and Fault suppression
- Topological Mapping
- Events and Alarms

SECTION 1

Virtualization Technologies

Hardware-level Virtualization

Hardware-level virtualization technologies, such as VMware and Solaris Logical Domains (LDM's) allows for the sharing of the underlying physical machine resources between different Virtual Machines (VMs), each running its own operating system. A software layer called the virtual machine monitor or hypervisor provides the management of the virtualization. In addition, hardware-level virtualization allows multiple OS environments to co-exist on the same hardware, in strong isolation from each other.

Operating System-level Virtualization

Operating System-level virtualization provides a level of isolation within a single operating system. The OS kernel allows for multiple, isolated user-space instances. These instances maintain the look and feel of an actual server, from the perspective of the user. These instances, often referred to as zones, containers or jails, do not have separate kernels.

SPECTRUM'S VIRTUALIZATION ROADMAP

New Virtual Host Manager

Target GA Date: 1H 2009

Target Release: SPECTRUM 9.1

- New discovery of ESX servers, Virtual Machines (VMs), clusters, resource pools, logical mapping, VMotion support, and comprehensive OneClick views that detail the Virtual Machines or guests hosted by ESX servers. The capabilities combine to provide management of the health and availability of virtualized environments.
- The solution leverages data pulled from CA Virtual Performance Management (VPM) that allows for data collection from VMWare's vCenter as an alternative to SNMP from the ESX.

SECTION 2

Modeling VMware

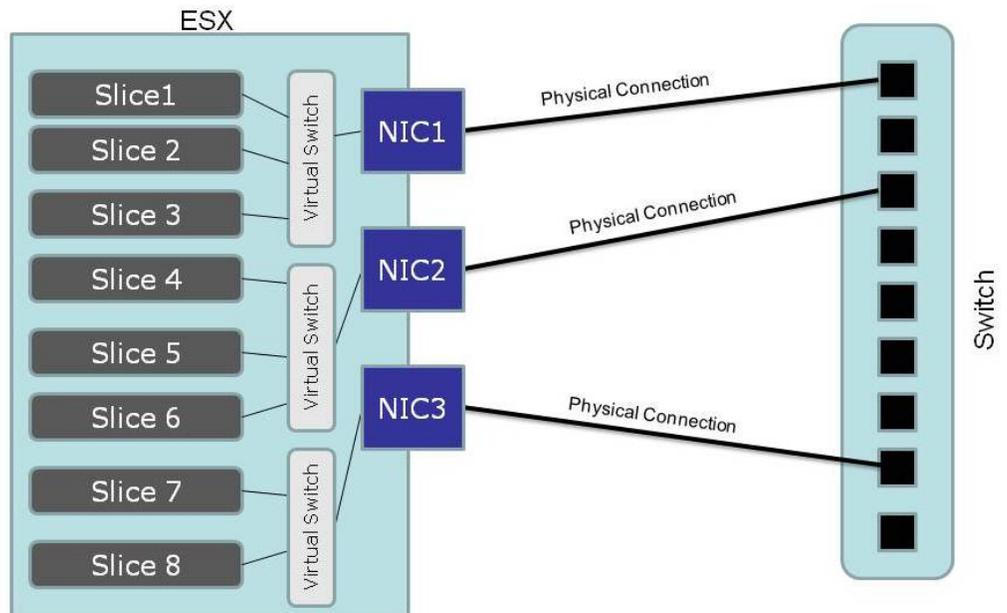
This section will discuss the management and modeling methods utilized by SPECTRUM r8.1 and r9.0. In addition, the functionality of the new Virtual Host Manager will be discussed.

AN ESX RUNNING VMWARE

FIGURE A

FIGURE A

Within the ESX, VMware sets up virtual switches, complete with their own address tables. This mechanism allows VMware to assign each slice, or VM, its own virtual MAC address. These are the MAC addresses that will be seen at the actual network switch.

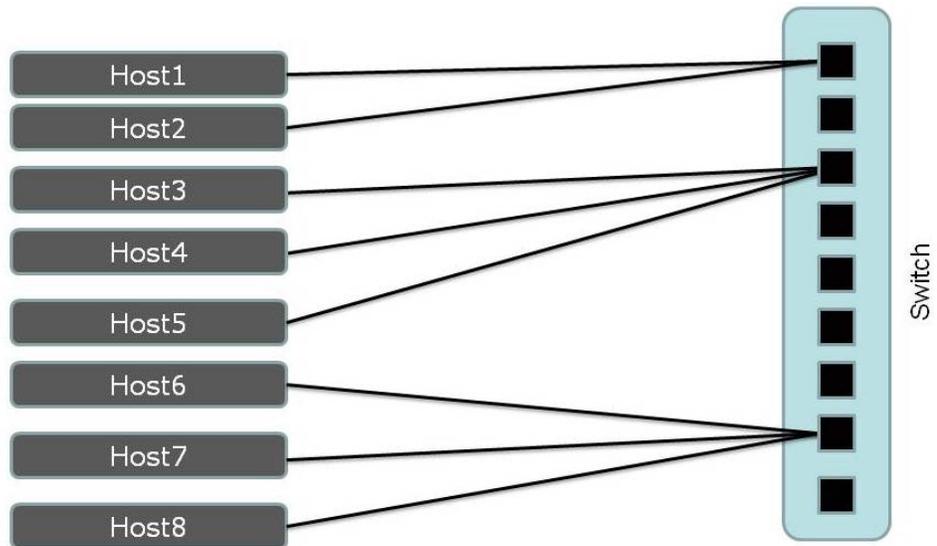


THE LOGICAL TOPOLOGY

FIGURE B

FIGURE B

The challenge here is that SPECTRUM reads the network switch's address table and hears multiple MAC addresses on one port. Therefore, actual Host-to-switch port resolution is unable to be ascertained.

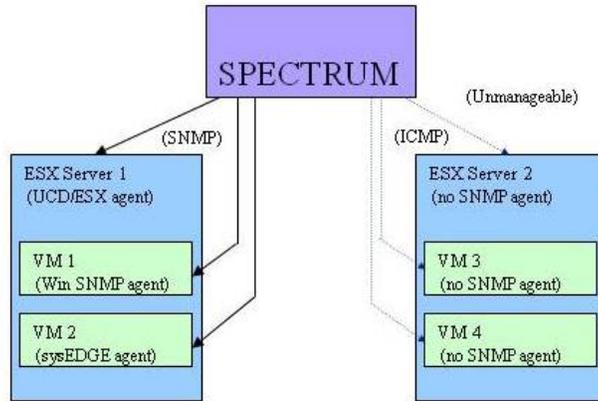


DIRECT SNMP MANAGEMENT

FIGURE C

FIGURE C

To directly manage the ESX and the VMs in SPECTRUM an SNMP agent must be running in the ESX Service Console. In addition, each of the VMs to be managed must have their own SNMP agents installed and running.

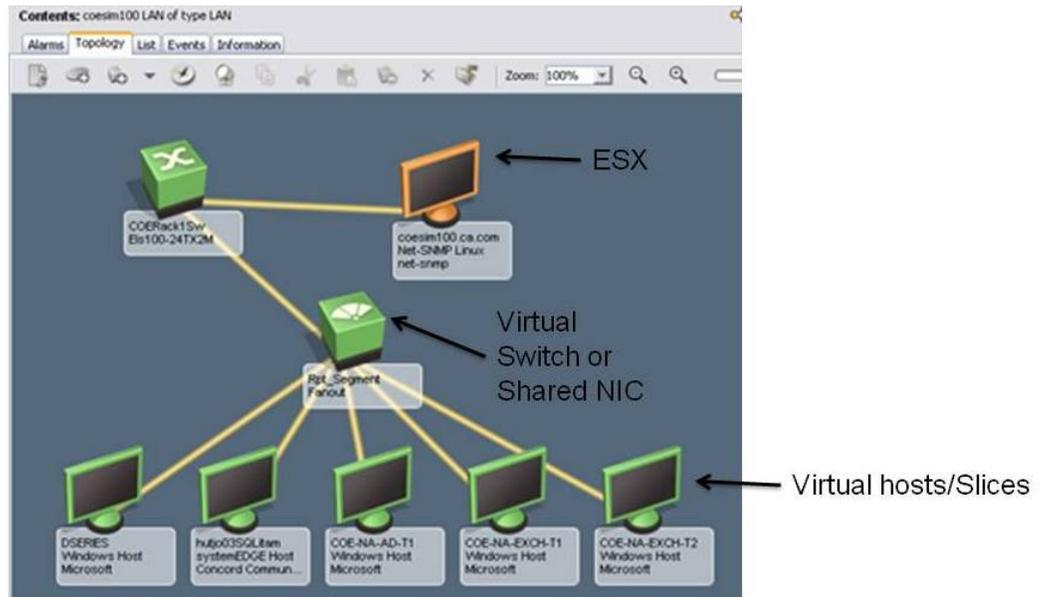


MODELING THE TOPOLOGY IN SPECTRUM

FIGURE D

FIGURE D

Model the ESX and VMs individually via SNMP. There is no association between an ESX model and its VM models



SPECTRUM can discover and model this environment providing a Layer 2 view of the ESX environment. However, logical associations between ESX and VM models are not shown. Fanout models will be used where multiple VMs bind to a single NIC via a virtual switch within the ESX host.

The Future Solution

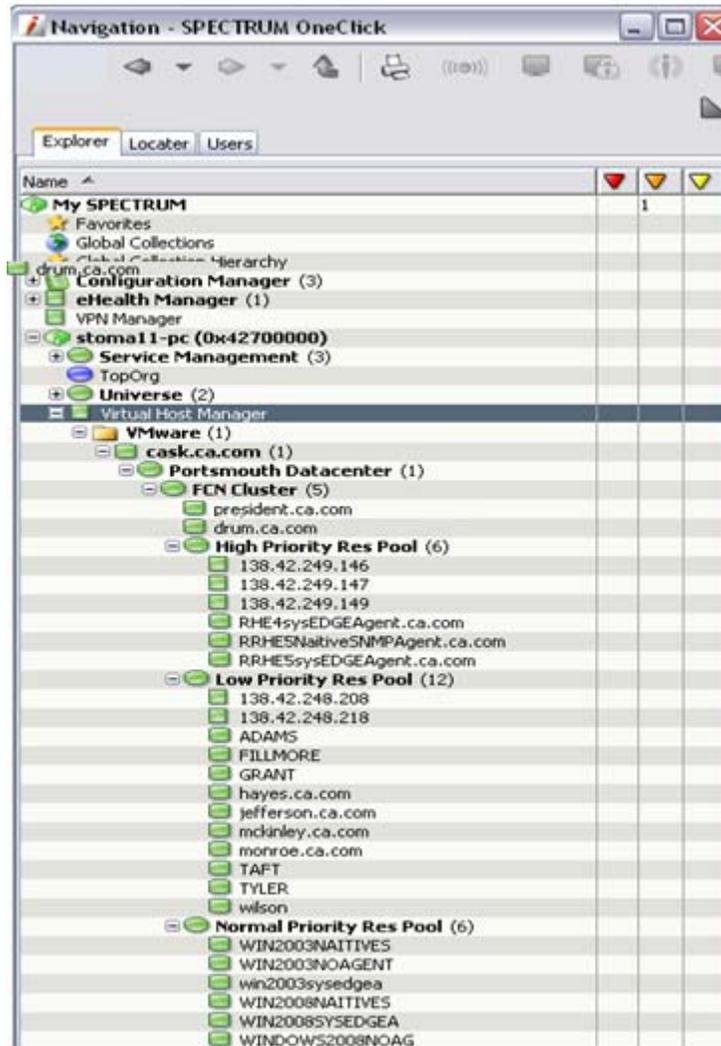
Future ESX releases likely will not provide an SNMP agent in the Service Console (ESXi and post ESX 3.5). Therefore, VMware recommends using its Virtual Center (VC) application to manage collections of ESX servers. Using the VC to manage the ESX will allow SPECTRUM to support such distributed features as: VMotion, HA, clusters and resource pools. SPECTRUM will utilize the systemEDGE agent (with a VC-interfacing AIM) as a proxy to the VC application. There will be no need for SNMP agents on the ESX or any of the guest hosts (VMs). However, if an SNMP agent is installed it will provide additional management capabilities based on normal SNMP management.

ONECLICK NAVIGATION PANEL

FIGURE E

FIGURE E

The Virtual Host Manager icon will be added under each landscape. This will provide a consolidated view of all VCs, DCs, ESXs, VMs, clusters and Resource Pools on each landscape and will show logical groupings of these entities.



ONECLICK FEATURES

INFORMATION VIEW

- **VC SystemEDGE**
 - VC AIM Configuration
 - General Status Counters
 - Virtual Center Stats
 - Datacenters
 - Clusters
 - Resource Pools
 - ESX Hosts
 - Virtual Machines
 - Templates
 - Disks
 - Network
 - Sensors
 - Events

- **These will contain the relevant table entry:**
 - Datacenter
 - Cluster
 - Resource Pool
 - ESX Host
 - Virtual Machines

- **ESX Host**
 - If SNMP capable, the Information View will contain additional details:
 - VM table
 - Configuration
 - Utilization

- **Trap Support**
 - Support all 66 traps defined by the VC AIM MIB
 - All trap events and alarms will be asserted on the VC model

SECTION 3

Modeling Solaris Zones

While a Solaris Container or Zone is similar in many regards to a VMware slice, the underlying technology is different and therefore there are some subtle differences in how this environment is modeled in SPECTRUM.

There is always at least one zone defined, this is known as the "global" zone. Zones hosted by a global zone are known as "non-global zones." The global zone encompasses all processes running on the system, whether or not these processes are running within a non-global zone. Each zone has its own hostname, virtual network interfaces, and storage assigned to it. Zones act as completely isolated virtual servers within a single operating system instance.

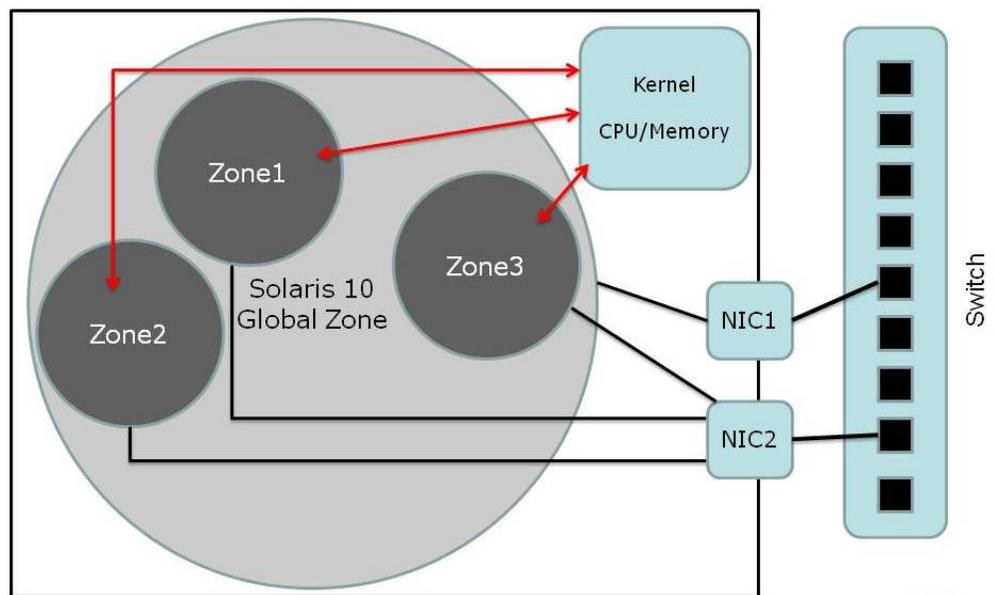
Some zones have their own set of operating system files, these are called "Whole Root" Zones, while others share the most of the filesystem content with the Global Zone, these are called "Sparse" Zones.

Unlike VMware which provides the virtual switch, the Solaris Zones access the network via virtual IP addresses and can be set up to share NICs or can be assigned a dedicated NIC.

SOLARIS ZONES

FIGURE F

FIGURE F
All zones can use any CPU core or thread when they need it, although utilization limits can be set. Typically, the Global Zone will connect via a dedicated NIC while the Non-Global Zones will share one or more NICs, thereby sharing the NIC's MAC address as well.

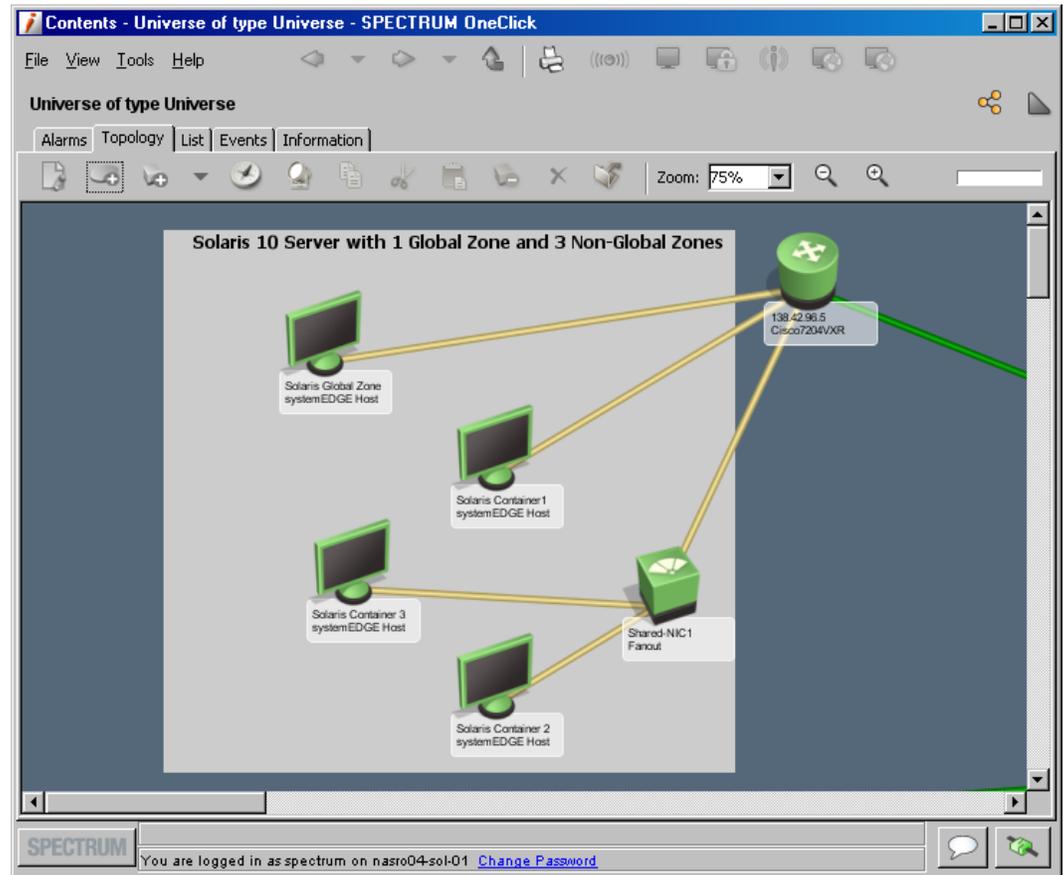


MODELING THE TOPOLOGY IN SPECTRUM

FIGURE G

FIGURE G

To ensure proper fault isolation and fault suppression, the Non-Global Zone hosts should be connected to the switch via a fanout model if the zones are sharing a NIC. A zone with a dedicated NIC would directly connect to the switch.



The topology is modeled similar to the ESX/VMware scenario, providing a view of the layer 2 connections, where the Fanout model represents the shared-NIC. Whether fanouts are used will depend on if the zones are set up to shared a NIC or if they have their own dedicated NICs. In the scenario indicated by FIGURE G, the Fault Isolation/ Fault Suppression is based on network connectivity. Furthermore, Condition Correlation rules can be set up monitor the overall health of the Solaris Zones, Global and non-Global and provide root cause in the event that the Global Zone has issues that impact the subordinate Non-Global Zones.

Due to the fact that the Global Zone is aware of the IP addresses used by the Non-Global Zones and that the Non-Global Zones may share the same MAC address, SPECTRUM may generate Duplicate MAC Different IP alarms.

To stop generating the Duplicate MAC Different IP alarms, set NeedDuplicateMACDiffIP (0x11ce2) to 'No'.

SECTION 4

Conclusions

The ability to successfully manage virtualized environments within SPECTRUM is critical to our customers. CA realizes that the ability to seamlessly manage both physical & virtual environments within our products is critical to our customers. Outlined in this document are best practices that we suggest customers use as options to achieve this goal with capabilities available in Spectrum 9.0 SP1. With the release of SPECTRUM 9.1, the new Virtual Host Manager will also bring additional functionality and management capabilities. As always, we look forward to expanding upon these capabilities in future releases of Spectrum.

SECTION 6

About the Author

Roger Nason has been associated with the SPECTRUM product for 15 years. He was a senior instructor for the SPECTRUM product under Cabletron and developed and taught classes for many of the company's largest customers. In addition, he has served as a UNIX System Administrator and SPECTRUM Administrator for the Liberty Mutual Insurance Group. He is currently the Backline Core Team Lead Support Engineer in the SPECTRUM Support Group at CA.