Virtualization Standards for Business Continuity: Part 5

This is the fifth of a series of articles defining the policies, guidelines, standards, and procedures that provide the foundation of a virtualized environment, thus enabling business continuity, disaster recovery, and high availability, with an emphasis toward Return On Investment (ROI).

One of the most difficult tasks in a virtualized AIX environment is identification and association of resources such as virtual SCSI adapters, virtual ethernet adapters, and storage. These tasks become even more difficult in large environments such as the p590 where there may be dozens, if not hundreds of LPAR's on a single frame. The greatest difficulty lies in maintenance and updates of existing virtualized LPAR's where there may be hundreds of disks configured on each VIO server. The ability of the system administrator to accurately identify which virtual SCSI adapters and disks are associated with each client LPAR is critical. Misidentification can lead to corruption of data and extended outages. A rigid set of policies, guidelines, standards, and procedures can help simplify and automate these administration tasks.

This article will focus primarily on defining the slot numbering scheme for virtual ethernet adapters. The virtual SCSI adapter slot numbering scheme will be discussed at a high level in this article and will be covered in detail in the next article of this series. The reasons for standardizing these numbering schemes are:

- Identification of adapters
- Association of each adapter to VIO Server
- Association of each adapter to client LPAR
- Segmentation of network traffic
- Automation of system configuration, management, and monitoring

When defining virtual SCSI adapters on the VIO server, it requires that each adapter be associated with a "slot" number, these slot numbers can be any integer greater than 0, and for the purpose of discussion in this article, less than 1000. The upper limit is actually greater than 1000 and appears to increase with each VIO server update, so rather than provide inaccurate information regarding the upper limit, this article will arbitrarily use the value of 999 as the upper limit defined by the system administrator on each VIO server.

The first step in developing slot numbering standards is to divide this range of slot numbers into those that will be used for virtual ethernet adapters, and those used for virtual SCSI adapters. A recommended division is as follows:

- Slot numbers 10 – 499: virtual SCSI adapters
- Slot numbers 500 – 999: virtual ethernet adapters

In this series of articles, it has been assumed the virtual configuration is that of a dual VIO server arrangement on each frame, this assumption will be continued here. Therefore, in order to easily identify which VIO server each adapter is associated, only even number slots will be used on even numbered VIO servers (using the node and host naming standard from part 1 of this series), and only odd numbered slots will be used on odd numbered VIO servers. Typically only two VIO servers are configured on a single frame, however there are situations where more than two VIO servers may be desired on a single frame. In those instances, a further segmentation of slot numbers may be required, but it will not be discussed here.

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To illustrate the slot numbering scheme, the example VIO server names from previous articles will be used as shown in table 5.1:

VIO Server Name	***VIO Server Location***	***Managed System Name***	***Frame***
dalapvio00	First VIO Server node on the 1st frame	Server-9119-590-SN12A345B	A
dalapvio01	Second VIO Server node on the 1st frame	Server-9119-590-SN12A345B	A
dalapvio02	First VIO Server node on the 2nd frame	Server-9119-590-SN67D890E	B
dalapvio03	Second VIO Server node on the 2nd frame	Server-9119-590-SN67D890E	B

Table 5.1: Example VIO Server names

For the remainder of this article, the p590 frame identified by the managed system name "Server-9119-590-SN12A345B" will be referred to as frame "**A**" and the p590 frame identified by the managed system name "Server-9119-590-SN67D890E" will be referred to as frame "**B**".

The standardized slot numbering schemes presented here are specific to the type of virtual adapter that will be assigned the slot number, for example the slot numbering scheme for virtual ethernet adapters is different that used for virtual SCSI adapters.

An additional consideration when configuring virtual ethernet adapters is the assignment of VLAN ID numbers. As a standard for the purpose of this article, the value of the third octet of IP addresses with a 255.255.255.0 subnet mask will be used as the VLAN ID. For example, an adapter that will be assigned an IP address of "10.1.2.3", will have a VLAN ID of "2", since this is the value of the third octet of that IP address. Depending upon your version of HMC code, the VLAN ID number may be referenced as the PVID number, please note this PVID is different than the physical volume ID (PVID) number associated with an hdisk. The latest versions of the HMC code refer to this as the VLAN ID.

Under the "standard" for creating virtual ethernet adapters described here, the "slot number" and "virtual LAN ID" number will always be the same number when configuring each individual adapter. Each virtual ethernet adapter on each VIO server on a frame, will have a unique value that is only assigned to that adapter. This standard helps system administrators with the ability to easily identify, monitor, manage, and support the virtualized environment.

The "slot" numbering scheme for virtual ethernet adapters assumes each adapter is composed of a three (3) digit number in the range of 500 – 999. Each digit of the number represents a category associated with various types of adapters.

The first digit identifies the type of service for which the adapter will be used, such as for application service networking, high availability standby, backup network, management access network, etc. as shown in table 5.2.

Slot Number	**Type of Service**
500 - 599	Boot / Application Service Network

600 - 699	High Availability Standby Adapter
700 - 799	Backup / Recovery Network
800 -899	System Management Network
900 - 999	Intra-Frame Network

Table 5.2: Virtual Ethernet Adapter – First Digit Value

The second digit of the three digit slot number associated with virtual ethernet adapters identifies underlying physical adapter speed. For example if a virtual adapter will be associated with one or more gigabit ethernet adapters, the second digit of the slot number will be a zero (0). This association is arbitrary and can be adjusted to whatever works best in your environment. Table 5.3 shows an example standard for assigning the second digit of the virtual ethernet adapter slot number:

Second Digit	Example Slot Number	Adapter Function	Adapter Speed
0	500	Boot / Application Service Network	Gigabit
1	510	Boot / Application Service Network	10/100/1000
5	550	Boot / Application Service Network	10/100
6	560	Boot / Application Service Network	10
9	590	Boot / Application Service Network	Bus Speed
0	700	Backup / Recovery Network	Gigabit
1	710	Backup / Recovery Network	10/100/1000
5	750	Backup / Recovery Network	10/100
6	760	Backup / Recovery Network	10/
9	790	Backup / Recovery Network	Bus Speed

Table 5.3: Virtual Ethernet Adapter – Second Digit Value

The third digit of the virtual ethernet adapter slot number represents the VIO server on which the adapter is configured. Even numbered slots should be configured on even numbered VIO servers (according to node name, see example VIO server node names above). Odd numbered slots should be configured on odd numbered VIO servers. Table 5.4 provides examples:

Frame	VIO Server Name	Example Slot Number	Adapter Function	Adapter Speed
A	dalapvio00	500	Boot / Application Service Network	Gigabit
A	dalapvio00	510	Boot / Application Service Network	10/100/1000
A	dalapvio00	550	Boot / Application Service Network	10/100

A	dalapvio00	560	Boot / Application Service Network	10
A	dalapvio00	590	Boot / Application Service Network	Bus Speed
A	dalapvio01	501	Backup / Recovery Network	Gigabit
A	dalapvio01	711	Backup / Recovery Network	10/100/1000
A	dalapvio01	751	Backup / Recovery Network	10/100
A	dalapvio01	761	Backup / Recovery Network	10/
A	dalapvio01	791	Backup / Recovery Network	Bus Speed
B	dalapvio02	502	Boot / Application Service Network	Gigabit
B	dalapvio02	512	Boot / Application Service Network	10/100/1000
B	dalapvio02	552	Boot / Application Service Network	10/100
B	dalapvio02	562	Boot / Application Service Network	10
B	dalapvio02	592	Boot / Application Service Network	Bus Speed
B	dalapvio03	503	Backup / Recovery Network	Gigabit
B	dalapvio03	713	Backup / Recovery Network	10/100/1000
B	dalapvio03	753	Backup / Recovery Network	10/100
B	dalapvio03	763	Backup / Recovery Network	10/
B	dalapvio03	793	Backup / Recovery Network	Bus Speed

Table 5.4: Virtual Ethernet Adapter – Third Digit Value

To eliminate single points of failure and to provide high availability, each client LPAR is normally configured with multiple connections to each network. Using this standard, two network connections are provided to each LPAR, one from each of dual VIO servers on a frame. On the client LPAR the two network connections, one from each VIO server, are normally configured into an etherchannel.

In order to balance the network load across the dual VIO servers on a frame, the etherchannel on client LPARs with even numbered node names are configured using the virtual ethernet adapter provided by the VIO server with the even numbered node name as the primary channel, and the virtual ethernet adapter provided by the VIO server with the odd numbered node name as the backup channel. Client LPARs with odd numbered node names are configured vice versa as shown in table 5.5. The client LPAR names used in table 5.5 are example node names from part 1 of this series of articles.

Frame	Client LPAR Name	Slot Number/ VLAN ID	VIO Server Node Name	Etherchannel Priority
A	dalapora00	500/500	dalapvio00	primary

A	dalapora00	501/501	dalapvio01	secondary
A	dalapora01	500/500	dalapvio00	secondary
A	dalapora01	501/500	dalapvio01	primary
A	dalapora02	500/500	dalapvio00	primary
A	dalapora02	501/501	dalapvio01	secondary
A	dalapora03	500/500	dalapvio00	secondary
A	dalapora03	501/501	dalapvio01	primary
B	dalapora04	502/502	dalapvio02	primary
B	dalapora04	503/503	dalapvio03	secondary
B	dalapora05	502/502	dalapvio02	secondary
B	dalapora05	503/503	dalapvio03	primary
B	dalapora06	502/502	dalapvio02	primary
B	dalapora06	503/503	dalapvio03	secondary
B	dalapora07	502/502	dalapvio02	secondary
B	dalapora07	503/503	dalapvio03	primary

Table 5.5: Etherchannel virtual adapter priority

To determine the virtual ethernet adapter slot number on the client LPAR, use the “lscfg -vl entX” command, where “X” represents the adapter number. The client LPAR etherchannels can be configured using the SMIT fast path “smitty etherchannel”.

Through experience with the VIO servers, it has been found that it is desirable to configure an additional non-trunked virtual ethernet adapter for each network connected to the VIO server. This additional virtual ethernet adapter is not shared out to the client LPARs and is only used on the VIO server to provide network access for the VIO server on each physical network. IP addresses are configured on these additional adapters, not on any of the adapters in the shared ethernet adapter stack.

Frame	VIO Server Name	Example Slot Number/	Access External	IP Address

		VLAN ID Number	Network?	
A	dalapvio00	500/500	Yes (trunked)	No
A	dalapvio00	520/500 (additional adapter)	No (non-trunked)	Yes
A	dalapvio01	501/501	Yes (trunked)	No
A	dalapvio01	521/501 (additional adapter)	No (non-trunked)	Yes
B	dalapvio02	502/502	Yes (trunked)	No
B	dalapvio02	522/502 (additional adapter)	No (non-trunked)	Yes
B	dalapvio03	503/503	Yes (trunked)	No
B	dalapvio03	523/503 (additional adapter)	No (non-trunked)	Yes

Table 5.6: Additional virtual ethernet adapter on VIO server for IP addressing

The additional adapter is pointed to the VLAN ID of the virtual ethernet adapter that will be associated with the physical ethernet adapters when the shared ethernet adapter (SEA) is created on the VIO server. This will be described in detail in a later article.

The Business Continuity policies, guidelines, standards, and procedures to be learned from this article are as follows:

Policies:

- Multiple physical networks shall be available to eliminate network related single points of failure.
- Each physical frame shall have dual VIO servers.
- Each VIO server shall provide access to one or more physical networks.
- Each Client LPAR shall be provided with dual connections to each network from dual VIO servers.

Guidelines:

- Network traffic can be evenly distributed across dual VIO servers by prioritizing the virtual ethernet adapters on the client LPARs using an even/odd numbering scheme. On even numbered client LPARs virtual ethernet adapters from even numbered VIO servers have the highest priority, and vice versa on the odd numbered client LPARs.

Standards:

- This article provides a standardized slot numbering scheme for virtual ethernet adapters

provided by a VIO server.

Procedures:

- The "mkviolpar" script, provided in part 2 of this series of articles, is programmed to implement the slot numbering standard described in this article. A Korn shell script called "mklpar" to create the client LPARs, will be presented in a future article, and will also implement the client side of this slot numbering scheme.

The next article in this series will provide a standardized slot numbering scheme for the virtual SCSI adapter, a naming standard for virtual target devices (VTD), and will introduce the concept of resource groups. The resource group will be the basis of the business continuity, disaster recovery, and high availability naming structures recommended by this series of articles.

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