SR-IOV
Single Root IO Virtualization

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and
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IBM Power Systems Advanced Technical Sales Support (ATS)
Agenda

- **What is Single Root IO Virtualization**
  - Understanding some new terminology
- **Basic requirements**
  - Servers, firmware, HMC and Operating Systems
- **Flexible configuration scenarios**
- **Review the HMC user interface**
- **Performance observations**
- **Questions**
SR-IOV Technology

- The *Single Root I/O Virtualization and Sharing Specification* (SR-IOV) defines extensions to the PCI Express (PCIe) Specification to allow multiple operating systems running simultaneously within a single computer to share a PCI Express device.

- Specification was approved in 2007.

- **SR-IOV** is analogous to processor micro-partitioning:
  - Each LPAR owns a HW slice of an adapter. Adapter vendors are designing for greater than 32 “virtual” IO adapters per physical adapter.
    - Host Ethernet Adapter (HEA) was an IBM proprietary offering
    - OS-to-wire stack w/o VIOS intermediary
    - SR-IOV gives industry an HEA alternative
  - Enables *adapter consolidation through sharing*, much like LPAR enables server consolidation.

- **SR-IOV** is *modal*:
  - Traditional whole dedicated adapter, assigned/managed by one OS
  - IOV enabled to *share across* multiple OS’s
  - Flexible “size” virtual devices: choose *virtual device capacity to match LPAR workload*
PowerVM – SR-IOV Support

Challenge: How do we effectively share a small number of high bandwidth physical adapter ports with an ever growing number of Virtual Machines?

PowerVM SRIOV: The Single Root I/O virtualization standard allows efficient sharing of a single adapter. Each VM thinks it has a real physical adapter which is shared as a VF (virtual function).

Benefits:
- Improved Quality of Service Controls on IO for PowerVM
- Lower performance overhead for SRIOV
- Dedicated virtual resources for VMs
- Better utilization of higher bandwidth IO cards
- Offloads IO virtualization processing
- Reduces virtualization overhead for IO

PowerVM SR-IOV Support
- Dedicated or shared SR-IOV network adapters support allowing Virtual or native Ethernet,
- FCoE (CNA) FC capability is not currently supported when adapter is in SR-IOV mode
- LPM is limited to VFs assigned to a SEA
- IO Bandwidth Controls will be able to be set
- Multiple Virtual Functions (VF) share physical function (PF)
Initial SR-IOV Offering

- **SR-IOV Support**
  - Initial roll-out is for Ethernet NIC only
  - IBM Power7+ models 770 (9117-MMD) and 780 (9179-MHD)
  - Requires PCIe Gen2 slot
  - Adapters can be deployed in ‘Dedicated’ mode or SR-IOV mode
    - IBM i does not support Dedicated mode

- **Adapters**
  - Two Integrated Adapters
    - EN11 - 2 ports 10GBASE-T (10Gbs RJ45), 2 ports 10GBASE-SR (10Gbs OPTICAL-SR)
    - EN10 - 2 ports 10GBASE-T (10Gbs RJ45), 2 ports 10GSFP+Cu (10Gbs SFP+ TWINAX)
  - Two Standard PCI Express adapters
    - EN0H - 2 ports 1000BASE-T (1Gbs RJ45), 2 ports 10GBASE-SR (10Gbs OPTICAL-SR)
    - EN0K - 2 ports 1000BASE-T (1Gbs RJ45), 2 ports 10GSFP+Cu (10Gbs SFP+ TWINAX)
  - Maximum number of logical ports (VFs) supported varies by adapter
    - 40 logical ports (VFs) on the Integrated adapters
    - 48 logical ports (VFs) on the PCI Express adapters
Integrated Multifunction Cards

FC #1768 (Copper)
FC #1769 (Optical)

Dual 10 Gb Optical / 1 Gb Ethernet
Dual 10 Gb Copper / 1 Gb Ethernet

The New for 770/780 “C” & “D”

FC #EN10 (Copper)
FC #EN11 (Optical)

Dual 10 Gb Optical / 1/10 Gb Ethernet
Dual 10 Gb Copper / 1/10 Gb Ethernet

1 Gb / 100Mb RJ45 Ethernet
10 Gb Ethernet *
USB
Serial

10 Gb Ethernet *
USB
Serial

10Gb / 1Gb / 100Mb RJ45 Ethernet CAT-6A cabling

**Table:**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Annuc</th>
<th>eConfig</th>
<th>GA</th>
</tr>
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<tr>
<td>Additional IMFC for 770/780 #EN10/EN11</td>
<td>8 Apr</td>
<td>8 Apr</td>
<td>18 Apr</td>
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<tr>
<td>SR-IOV support on POWER7+ 770/780</td>
<td>8 Apr</td>
<td>n/a</td>
<td>10 Jun</td>
</tr>
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</table>
4-port 10GbE CNA/FCoE & 1GbE Adapter

- 10Gb Copper Twinax ports – EN0K
  Or
- 10Gb Copper SR ports – EN0H

- #EN0K – full high
- #EN0H – full high

2 ports 10GbE CNA

2 ports 1GbE NIC only

Announced 8 April 2014
For POWER7+ 710/720/730/740/750/760/770/780

SR-IOV for NIC function in POWER7+ 770/780 with 7.8 firmware or later

<table>
<thead>
<tr>
<th></th>
<th>Annc</th>
<th>eConfig</th>
<th>GA</th>
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</thead>
<tbody>
<tr>
<td>PCIe2 4-port Ethernet Adapter 10Gb + 1Gb, Copper Twinax or SR #EN0K/EN0H</td>
<td>8 Apr</td>
<td>8 Apr</td>
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<td>SR-IOV support on POWER7+ 770/780</td>
<td>8 Apr</td>
<td>n/a</td>
<td>10 Jun</td>
</tr>
</tbody>
</table>
## Requirements

- Power Systems 9117-MMD and 9179-MHD
- PCIe gen2 slots (i.e. no I/O drawer slots)
  - Adapters must be placed in the 770 or 780 CEC
- Software & Firmware versions
  - FW 780.10 (56)
  - HMC V7R790
  - IBM i 7.2 and IBM i 7.1 TR8
  - VIOS 2.2.3.2
  - AIX 6.1 Technology Level 9 + Service Pack & AIX 7.1 TL3 + SP
  - Linux SLES 11 SP3
## Features

- **Adapter sharing**
  - Improves partition to I/O slot ratio
  - Sharing by up to 48 partitions per adapter. Additional partitions with Virtual I/O Server (VIOS)

- **Direct access I/O**
  - Provides CPU utilization and latency roughly equivalent to dedicated adapters
  - Adapter sharing with advanced features such as Receive Side Scaling (RSS) and adapter offloads.

- **Simple server I/O deployment**
  - Minimal steps to add a logical port to partition or partition profile.

- **Flexible deployment models**
  - Single partition (Dedicated mode)
  - Multi-partition with or without VIOS (SR-IOV mode)
  - Multi-partition mix of VIOS and native LPAR

**IO Adapter Virtualization with SR-IOV**

VF = Virtual Function
Logical ports (VFs) include a capacity setting

- Simple, consistent approach to provision resources across SR-IOV adapter types.

- A logical port is referred to as a Virtual Function (VF)

- User specifies a logical port’s desired capacity (QoS) as a percentage of a port’s capability.
  - Assignments are made in increments of 2 %
  - This will ensure minimum capacity is delivered. It does NOT cap the bandwidth if extra is available
  - Total assignments for a single port can not exceed 100%

- Platform firmware provisions adapter and firmware resources based on desired capacity.
Flexible Deployment

- **Single partition (Dedicated)**
  - All adapter resources assigned to a single partition
    - Available for VIOS, AIX and Linux
    - IBM i does not support dedicated mode

- **Multi-partition without VIOS**
  - Direct access to adapter features
  - Capacity per logical port
  - Fewer adapters can provide fully redundant adapter configurations for each VM
Flexible Deployment

- **Multi-partition thru VIOS**
  - Supports Shared Ethernet Adapter features by VIOS setting Promiscuous mode
  - Fewer adapters for redundancy
  - VIOS client partitions using SEA are eligible for Live Partition Mobility
  - Allows class of service between VIOS clients

- **Multi-partition mix of VIOS and non-VIOS**
  - For VIOS partitions same as Multi-partition thru VIOS above
  - Direct access partitions
    - Path length & latency comparable to dedicated adapter ‘Performance’
    - Direct access to adapter features
    - Entitled capacity (QoS) per logical port
SR-IOV Configuration

- Two parts to SR-IOV configuration
  - Dedicated mode is factory default

1) Enable adapter for SR-IOV shared mode
  - SR-IOV capable adapters may be assigned to a partition as a “dedicated” adapter (i.e. No SR-IOV sharing) or enabled for SR-IOV sharing.
  - Generally will set adapter mode as a one time action –
    - Can be toggled between modes
  - Optionally configure physical ports

2) Create logical ports for partitions and/or profiles
  - A logical port maps to SR-IOV VFs
  - Logical port configuration persisted with partition or profile
  - Logical ports can be dynamically added to or removed from a partition
SR-IOV Configuration

- **Two parts to SR-IOV configuration**
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1) **Enable adapter for SR-IOV shared mode**
   - SR-IOV capable adapters may be assigned to a partition as a “dedicated” adapter (i.e. No SR-IOV sharing) or enabled for SR-IOV sharing.
   - One time activity.
   - Optionally configure physical ports

2) **Create logical ports for partitions and/or profiles**
   - A logical port maps to SR-IOV VFs
   - Logical port configuration persisted with partition or profile
   - Logical ports can be dynamically added to or removed from a partition
Start by - Select Server Properties

```
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<th>Status</th>
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<th>Environment</th>
<th>OS Version</th>
<th>Reference Code</th>
<th>Active Profile</th>
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<td>1</td>
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<td>0 IBM i</td>
<td>Unknown</td>
<td></td>
<td>dione</td>
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<td>Running</td>
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<td>16</td>
<td>128 IBM i</td>
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<td>degresp2</td>
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<td>8</td>
<td>0.5</td>
<td>4 AIX or Linux</td>
<td>AIX 7.1.7100-03-01-1341</td>
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<tr>
<td>i09raw</td>
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<td>0.25</td>
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<td>4 IBM i</td>
<td>IBM i Licensed Internal Code 7.2.0.3060.0</td>
<td>000000000</td>
<td>dagrobrHMC</td>
</tr>
</tbody>
</table>
```
### Verify SR-IOV Capabilities Indicator

1. If “SR-IOV Capable” entry is not found, you probably have the wrong CEC firmware (assuming you are on HMC 790).

2. If “SR-IOV Capable” entry says “False”, you'll need to activate PowerVM VET code on the managed system.

#### Capabilities Tab

<table>
<thead>
<tr>
<th>Capability</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware Discovery Capable</td>
<td>True</td>
</tr>
<tr>
<td>Active Partition Mobility Capable</td>
<td>True</td>
</tr>
<tr>
<td>Inactive Partition Mobility Capable</td>
<td>True</td>
</tr>
<tr>
<td>IBM i Partition Mobility Capable</td>
<td>True</td>
</tr>
<tr>
<td>Partition Processor Compatibility Mode Capable</td>
<td>True</td>
</tr>
<tr>
<td>Partition Availability Priority Capable</td>
<td>True</td>
</tr>
<tr>
<td>Electronic Error Reporting Capable</td>
<td>True</td>
</tr>
<tr>
<td>Active Partition Processor Sharing Capable</td>
<td>True</td>
</tr>
<tr>
<td>Firmware Power Saver Capable</td>
<td>True</td>
</tr>
<tr>
<td>Hardware Power Saver Capable</td>
<td>True</td>
</tr>
<tr>
<td>Virtual Switch Capable</td>
<td>True</td>
</tr>
<tr>
<td>Virtual Fibre Channel Capable</td>
<td>True</td>
</tr>
<tr>
<td>Active Memory Expansion Capable</td>
<td>True</td>
</tr>
<tr>
<td>Partition Suspend Capable</td>
<td>True</td>
</tr>
<tr>
<td>Partition Remote Restart Capable</td>
<td>True</td>
</tr>
<tr>
<td>PowerVM Partition Remote Restart Capable</td>
<td>True</td>
</tr>
<tr>
<td>Virtual Trusted Platform Module Capable</td>
<td>True</td>
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<td><strong>SR-IOV Capable</strong></td>
<td>True</td>
</tr>
<tr>
<td>Dynamic Platform Optimization Capable</td>
<td>True</td>
</tr>
<tr>
<td>Virtual Server Network Phase 2 Capable</td>
<td>True</td>
</tr>
</tbody>
</table>
Set the adapter mode

- To set adapter to shared mode

  click the hotlink of a SR-IOV capable adapter on the IO table, then click the “SR-IOV” tab:

  ![Image of IO table]

  ![Image of Physical I/O Properties]

  **Check the checkbox, then click OK**

  Close and reopen the IO table of the server, you will see the adapter shows being assigned to Hypervisor and the Logical Port limit has been change to the adapter logical port limit:

  ![Image of IO table after changes]

  Lesson learned: Although full support with IBM i is available with 7.1 TR8 and base 7.2, ensure all IBM i 7.1 have PTF MF57891
Switch adapter from shared mode to dedicated mode:
uncheck the “Shared Mode” checkbox on the SR-IOV tab of the adapter, and click OK.

If there are active or inactive partitions using the logical ports of the adapter, the operation will fail.

For logical ports being used by active partitions, go to “Dynamic Partition->SR-IOV Logical Ports” panel of each of those partitions to release them (see slide 14).

If only inactive partitions are using the logical ports of the adapter when the switch operation is performed, a release inactive logical ports panel will be displayed, and you can release them by clicking “Select All” and then clicking “OK”.

After releasing all logical ports, try the switch operation again.
Adapter in SR-IOV Shared Mode

- Adapter assigned to PHYP.
- Adapter type will define the number of Logical Ports.
- An empty PCIe Gen2 slot (SR-IOV capable) will show a default value of 96.
- PCI-X and currently available Gen1 PCIe IO drawers will show as not SR-IOV capable.
Two parts to SR-IOV configuration

1) Enable adapter for SR-IOV shared mode
   - SR-IOV capable adapters may be assigned to a partition as a “dedicated” adapter (i.e. No SR-IOV sharing) or enabled for SR-IOV sharing.
   - One time activity.
   - Optionally configure physical ports

Create logical ports for partitions and/or profiles
   - A logical port maps to SR-IOV VFs
   - Logical port configuration persisted with partition or profile
   - Logical ports can be dynamically added to or removed from a partition
Select adapter to configure physical ports.

<table>
<thead>
<tr>
<th>Slot</th>
<th>Description</th>
<th>Bus</th>
<th>I/O Pool Id</th>
<th>Owner</th>
<th>Type</th>
<th>Slot LP Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>U78AA.001.WH001T-P1-T3</td>
<td>RAID Controller</td>
<td>512</td>
<td>Unassigned</td>
<td>z2235ap1</td>
<td>N/A</td>
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</tr>
<tr>
<td>U78AA.001.WH001T-P1-T7</td>
<td>Universal Serial Bus UHC Spec</td>
<td>513</td>
<td>Unassigned</td>
<td>Unassigned</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>U78AA.001.WH001T-P1-C1</td>
<td>Empty slot</td>
<td>514</td>
<td>Unassigned</td>
<td>Unassigned</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>U78AA.001.WH001T-P1-C4</td>
<td>Empty slot</td>
<td>516</td>
<td>Unassigned</td>
<td>Unassigned</td>
<td>N/A</td>
<td></td>
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<tr>
<td>U78AA.001.WH001T-P1-C8</td>
<td>PCI-E SAS Controller</td>
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<td>N/A</td>
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</tr>
<tr>
<td>U78AA.001.WH001T-P1-C6</td>
<td>PCI-E SAS Controller</td>
<td>518</td>
<td>Unassigned</td>
<td>z2235ap1</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>U78AA.001.WH001T-P1-C7</td>
<td>PCIe2 4-port (10Gb FCoE &amp; 1GbE) SR&amp;I45 Adapter</td>
<td>519</td>
<td>Unassigned</td>
<td>Unassigned</td>
<td>N/A</td>
<td></td>
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<tr>
<td>U78AA.001.WH001T-P1-C1-C4</td>
<td>Empty slot</td>
<td>521</td>
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<td>Unassigned</td>
<td>96</td>
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<tr>
<td>U78AA.001.WH001T-P1-C1-C3</td>
<td>Empty slot</td>
<td>522</td>
<td>Unassigned</td>
<td>Unassigned</td>
<td>96</td>
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<tr>
<td>U78AA.001.WH001T-P1-C1-C1</td>
<td>Empty slot</td>
<td>523</td>
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<td>Unassigned</td>
<td>96</td>
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</tr>
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</table>

Total: 11  Filtered: 11
### Physical Port Table

SR-IOV shared mode allows a single adapter, usually with multiple physical ports, to provide high performance networking or data processing to many logical partitions through logical ports.

#### General
- **SR-IOV**

#### Adapter Information
- **Adapter ID**: 1
- **Total Supported Logical Ports**: 48
- **Available Logical Ports**: 48

#### Physical Ports

<table>
<thead>
<tr>
<th>Select</th>
<th>Location</th>
<th>Port ID</th>
<th>Type</th>
<th>Label</th>
<th>Sublabel</th>
<th>Config LPs</th>
<th>Speed</th>
<th>Link Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>U78AA.001.WI001T-P1-C1-C2-T1</td>
<td>0</td>
<td>Converged Ethernet</td>
<td>0</td>
<td></td>
<td>0</td>
<td>0</td>
<td>Down</td>
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<td></td>
<td>U78AA.001.WI001T-P1-C1-C2-T2</td>
<td>1</td>
<td>Converged Ethernet</td>
<td>0</td>
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<td>0</td>
<td>Down</td>
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<tr>
<td><strong>X</strong></td>
<td>U78AA.001.WI001T-P1-C1-C2-T3</td>
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<td>Ethernet</td>
<td>0</td>
<td>1Gbps</td>
<td></td>
<td></td>
<td>Up</td>
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<td></td>
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**Total**: 4  **Filtered**: 4  **Selected**: 0

#### Configured Logical Ports

<table>
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<th>Location</th>
<th>Type</th>
<th>Partition</th>
<th>Lpar Status</th>
<th>Capacity (%)</th>
<th>Diagnostic</th>
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</thead>
</table>

**Total**: 0
SR-IOV Shared Mode Physical Ports

Select the physical port for the logical port.

Indicates supported and available (i.e. not assigned to a partition) logical ports.

Label and Sublabel for physical port

---

### Physical I/O Properties - ATS_780

SR-IOV shared mode allows a single adapter, usually with multiple physical ports, to provide high performance networking or data processing to many logical partitions through logical ports.

**Shared Mode**
- Adapter ID: 2
- Total Supported Logical Ports: 40
- Available Logical Ports: 36

### Physical Ports

<table>
<thead>
<tr>
<th>Select</th>
<th>Location</th>
<th>Port ID</th>
<th>Type</th>
<th>Label</th>
<th>Sublabel</th>
<th>Config LPs</th>
<th>Speed</th>
<th>Link Status</th>
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<td></td>
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<td>0</td>
<td>Ethernet</td>
<td>Flintrock101</td>
<td>sbnet101</td>
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<td>1Gbps</td>
<td>Up</td>
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<td>Ethernet</td>
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<td>subnet85</td>
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**Total:** 4 **Filtered:** 4 **Selected:** 1

### Configured Logical Ports

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<tr>
<th>Physical Port</th>
<th>Location</th>
<th>Type</th>
<th>Partition</th>
<th>Lpar Status</th>
<th>Capacity (%)</th>
<th>Diagnostic</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>U2C4E.001.DBJY198-P2-C8-T1-S1</td>
<td>Ethernet</td>
<td>PANDORA</td>
<td>Running</td>
<td>50.00</td>
<td>0</td>
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<td>Running</td>
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<td>Ethernet</td>
<td>PAN</td>
<td>Running</td>
<td>2.00</td>
<td>0</td>
</tr>
</tbody>
</table>
Create as many logical ports as you want in the profile, edit or remove if necessary. Finish the profile creation.

When you activate the profile, HMC will configure the logical ports as you specified in the profile, that's when the resources are taken from the adapters and HMC will do validations to make sure resources are available.

After the profile activation, you'll be able to see these SR-IOV logical ports from: Logical Partition->Properties->SR-IOV Logical Ports

**Partitions with SR-IOV logical port cannot be migrated (LPM).** You'll need to DLPAR them out before you migrate them.
Ethernet Physical Port Properties

Optional Label and Sub-label.
Port Switch Mode

Select the virtual Ethernet bridge (VEB) or virtual Ethernet port aggregator (VEPA) switch mode for the physical port. You can change the port switch mode only when there are no configured logical ports on the physical port. That is, the number of available logical ports is equal to the maximum number of logical ports. The VEB mode allows the logical ports that are on the same physical port to communicate with each other, without any traffic flowing through the physical port. The VEPA mode sends all the logical port traffic through the physical port. For logical ports which are on the same physical port, to communicate with each other when the port switch mode is set to VEPA, the switch attached to the physical port must support reflective relay service.

### Logical Port Limits

Specifies the total, maximum, and available number of configured logical ports that are supported by the system firmware for the selected physical port. **Total Supported** is the total number of allocated logical ports supported by the physical port. The physical port might have additional logical port limits based on the logical port type. **Supported** is the number of logical ports of the specified type (for example, Ethernet) supported by the physical port. **Max** is the maximum number of logical ports that can be allocated to logical partitions. This maximum value is either a default value that is determined by the hypervisor or a user specified value that cannot exceed the value specified in the **Supported** column. Generally, it is not required for you to change this value from the default value. **Available** is the number of logical ports that are not allocated to an active or shutdown logical partitions. This available value cannot exceed the value that is specified in the **Max** column.

<table>
<thead>
<tr>
<th>Logical Port Limits</th>
<th>Max</th>
<th>Available</th>
<th>Supported</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>
Two parts to SR-IOV configuration

Enable adapter for SR-IOV shared mode
  - SR-IOV capable adapters may be assigned to a partition as a “dedicated” adapter (i.e. No SR-IOV sharing) or enabled for SR-IOV sharing.
  - One time activity.
  - Optionally configure physical ports

Create logical ports for partitions and/or profiles
  - A logical port maps to SR-IOV VFs
  - Logical port configuration persisted with partition or profile
  - Logical ports can be dynamically added to or removed from a partition
If the owner partition is running AIX or Linux, to see the OS device names for the configured SR-IOV logical ports, RMC connection to the owner partition is needed, otherwise, “Unknown” will be shown on the “Device Name” column.
Create LPAR Wizard

New Step (If you have at least one SR-IOV adapter in shared mode)
Select Physical port to define VF properties

1. Capacity has to be a multiple of the default value. Capacity is a percentage of the physical port resources.

2. If you configure a LP in Diagnostic mode, you cannot configure any other LPs on the same physical port.

3. Promiscuous mode only goes with “Allow All VLAN Ids” and “Allow all O/S Defined MAC Addresses” on the Advanced options.

Lesson Learned: Unlike the HEA (IVE), Promiscuous mode can be selected for one LPAR and coexist with other VFs on the same physical port.
1. Capacity has to be a multiple of the default value. Capacity is a percentage of the physical port resources.

2. If you configure a LP in Diagnostic mode, you cannot configure any other LPs on the same physical port.

3. Promiscuous mode only goes with “Allow All VLAN Ids” and “Allow all O/S Defined MAC Addresses”

4. VLAN restriction and MAC restriction settings need to be consistent, which means “Allow All VLAN Ids” goes with “Allow all O/S Defined MAC addresses”, the non-allow-all VLAN options go with the non-allow-all MAC options.

5. Configuration ID is used by HMC only. It’s recommended to always use the default.
Two parts to SR-IOV configuration

Enable adapter for SR-IOV shared mode

- SR-IOV capable adapters may be assigned to a partition as a “dedicated” adapter (i.e. No SR-IOV sharing) or enabled for SR-IOV sharing.
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### DLPAR a SR-IOV Logical Port

#### Systems Management
- Servers
  - ATS_740D
  - ATS_780
- Custom Groups
  - AL Partitions
  - AL Objects
  - Power Enterprise Pools
- System Plans
- HMC Management
- Service Management
- Updates

#### Table: Systems Management

<table>
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<th>Name</th>
<th>ID</th>
<th>Status</th>
<th>Processing Units</th>
<th>Memory (GB)</th>
<th>Environment</th>
<th>OS Version</th>
</tr>
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<tr>
<td></td>
<td>PAN</td>
<td>1</td>
<td>Running</td>
<td>1</td>
<td>4</td>
<td>Virtual I/O Server</td>
<td>VIOS 2.2.3.2</td>
</tr>
<tr>
<td></td>
<td>PAIDORA</td>
<td>2</td>
<td>Running</td>
<td>1</td>
<td>4</td>
<td>Virtual I/O Server</td>
<td>VIOS 2.2.3.2</td>
</tr>
<tr>
<td></td>
<td>Ymir</td>
<td>3</td>
<td>Running</td>
<td>2</td>
<td>16</td>
<td>IBM i</td>
<td>IBM i Licensed Internal Code 7.1.0 410 0</td>
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<tr>
<td></td>
<td>farbauti</td>
<td>4</td>
<td>Not Activated</td>
<td>1</td>
<td>4</td>
<td>Virtual I/O Server</td>
<td>VIOS</td>
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<tr>
<td></td>
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<td>8</td>
<td>Running</td>
<td>0.5</td>
<td>4</td>
<td>AIX or Linux</td>
<td>AIX 7.1 7100-03-01-1341</td>
</tr>
</tbody>
</table>

#### Diagram: SR-IOV Logical Ports - DAGRclon

- **Add Logical Port**
- **Edit Logical Port**
- **Remove Logical Port**

**Properties**
- Processor
- Memory
- Virtual Adapters
- Physical Adapters

**SR-IOV Logical Ports**

**Serviceability**
- Host Ethernet
1. You can only DLPAR Add logical ports to running partitions, but you can DLPAR remove and DLPAR edit logical ports on running and shutdown partitions.

2. For AIX/Linux partitions, if the partition is running, for add or remove logical ports, RMC connection to the partition is needed, otherwise you'll need to run drmgr command on the OS. For edit logical ports, RMC is not needed.

3. For AIX/Linux partitions, HMC won't perform configMgr or rmdev on the partition. You'll need to do this action manually on the OS.
DLPAR the VF uses the same Wizard

Add Ethernet Logical Port - DAGRclon

Select the SR-IOV Port you would like to create the corresponding Logical Port from.

<table>
<thead>
<tr>
<th>Select</th>
<th>Adapter Id</th>
<th>Physical Port</th>
<th>Label</th>
<th>Sublabel</th>
<th>Speed</th>
<th>Active LPs</th>
<th>Available LPs</th>
<th>Link Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>U2C4E.001.DB1Y198-P2-C8-T1</td>
<td>Flintrock101</td>
<td>sbnet101</td>
<td>1Gbps</td>
<td>3</td>
<td>7</td>
<td>Up</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>U2C4E.001.DB1Y198-P2-C8-T2</td>
<td>Flintrock85</td>
<td>subnet85</td>
<td>1Gbps</td>
<td>1</td>
<td>9</td>
<td>Up</td>
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<td>2</td>
<td>U2C4E.001.DB1Y198-P2-C8-T3</td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>Down</td>
</tr>
<tr>
<td></td>
<td></td>
<td>U2C4E.001.DB1Y198-P2-C8-T4</td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>Down</td>
</tr>
</tbody>
</table>

Logical Port Properties - DAGRclon

Logical Port Information

- Adapter ID: 2
- Physical Port ID: 0
- Logical Port Type: Ethernet
- Logical Port Location: n/a

General | Advanced

Partition Information

- Partition ID: 55
- Partition Name: DAGRclon

Resources

- Capacity (%): 2.00

Permissions

- [ ] Diagnostic
- [ ] Promiscuous (exclusive with some advanced options)

VLANs

- Port VLAN ID: 0 (Valid values: 0, 2 - 4094)

VLAN Restrictions

- [ ] Allow All VLAN IDs
- [ ] Deny VLAN-Tagged Frames
- [ ] Specify Allowable VLAN IDs (Valid values: 2 - 4094)

Priorities

- Port VLAN ID (PVID) Priority: 0

MAC Address

- MAC Address: Auto-Assigned [ ] Override
- MAC Address Restrictions

- [ ] Allow all O/S Defined MAC Addresses
- [ ] Deny all O/S Defined MAC Addresses
- [ ] Specify Allowable O/S Defined MAC Addresses
**On IBM i – resource looks like this**

```
<table>
<thead>
<tr>
<th>Opt</th>
<th>Resource</th>
<th>Type</th>
<th>Status</th>
<th>Text</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LIN02</td>
<td>2C4C</td>
<td>Operational</td>
<td>Comm Adapter</td>
</tr>
<tr>
<td></td>
<td>CMN11</td>
<td>2C4C</td>
<td>Operational</td>
<td>Ethernet Port</td>
</tr>
</tbody>
</table>
```

**On AIX - might look like this**

```
$ lsdev |grep ent
ent0  Defined Int Multifunction Card w/ Copper SFP+ 10GbE (a21910
0714100a04)
ent1  Defined Int Multifunction Card w/ Copper SFP+ 10GbE (a21910
0714100a04)
ent2  Defined Int Multifunction Card w/ Base-TX 10/100/1000 1GbE
(a21910071410d203)
ent3  Defined Int Multifunction Card w/ Base-TX 10/100/1000 1GbE
(a21910071410d203)
ent4  Available 10GbEbaseT 4-port Integrated Multifunction CNA VF (df
1028e214103b04)
ent5  Available Virtual I/O Ethernet Adapter (1-lan)
ent6  Available Virtual I/O Ethernet Adapter (1-lan)
ent7  Available Virtual I/O Ethernet Adapter (1-lan)
ent8  Available Virtual I/O Ethernet Adapter (1-lan)
```
When VM is active, Capacity and Promiscuous settings can not be modified, nor can VLAN Restriction or MAC Address Restrictions. If changes are desired, options are to change in partition profile activate at next IPL, or DLPAR remove, change it and DLPAR in again.
1. Every time a change (mode change, physical port properties change) is made to the adapter, the new configuration is automatically backed up to the HMC's hard drive.

2. You can also manually backup the current configuration to a specific backup file
   (Server->Configuration->Manage Partition Data->Backup (specify filename))

3. When you run restore to that file, HMC will attempt to restore the adapter configuration.
   (Server->Configuration->Manage Partition Data->Restore(select the file you specified earlier)

**There are a few restrictions.** HMC cannot switch an adapter to shared mode and restore physical port properties in one operation due to the delay caused by mode switching. So please be aware of the following:

1) If the adapter is currently in dedicated mode, and the backup file had it in shared mode, HMC will only restore the adapter configuration (switch it to shared mode). (Note that when the CEC is initialized, the adapter will be put into dedicated mode.)

2) If the adapter is currently in shared mode, and the backup file had it in dedicated mode, HMC won't do anything.

3) If the adapter is currently in dedicated mode, and the backup file had it in dedicated mode, HMC won't do anything.

4) If the adapter is currently in shared mode, and the backup file had it in shared mode, HMC will restore the physical ports settings.

HMC will ignore all failures related to restoring the adapter/physical port properties.
1. List SR-IOV adapters/physical ports/logical ports on a managed system:
   - `lshwres -m sys1 -r sriov --rsubtype adapter`
   - `lshwres -m sys1 -r sriov --rsubtype physport --level ethc`
   - `lshwres -m sys1 -r sriov --rsubtype logport --level eth` (list configured eth logical ports)
   - `lshwres -m sys1 -r sriov --rsubtype logport` (list all unconfigured logical ports)

2. Switch adapter to shared mode
   - `chhwres -m sys1 -r sriov --rsubtype adapter -o a -a "slot_id=21010208,adapter_id=1"`

3. Switch adapter to dedicated mode
   - `chhwres -m sys1 -r sriov --rsubtype adapter -o r -a "slot_id=21010208"`

4. Set physical port attributes
   - `chhwres -m sys1 -r sriov --rsubtype physport -o s -a "adapter_id=1,phys_port_id=1,conn_speed=10000"`

5. DLPAR
   - `chhwres -m sys1 -r sriov --rsubtype logport -p mylpar -o a -a "adapter_id=1,phys_port_id=2,port_type=eth,allowed_vlan_ids="100,101""` (add)
   - `chhwres -m sys1 -r sriov --rsubtype logport -p mylpar -o s -a "adapter_id=1,logical_port_id=27004001,allowed_vlan_ids+=102"` (edit)
   - `chhwres -m sys1 -r sriov --rsubtype logport -p mylpar -o r -a "adapter_id=1,logical_port_id=27004001"` (remove)
Most used commands (continued)

6. Create Partition or Profile – Assign Logical Port

mksyscfg -m mysystem -r lpar -i "name=aixlpar,profile_name=profile1,par_env=aixlinux,
min_mem=512,desired_mem=1024,max_mem=2048, sriov_eth Logical_ports=adapter_id=1:phys_port_id=1" (use all
defaults)

mksyscfg -m mysystem -r prof, -i "name=test,profile=test,min_mem=512,desired_mem=1024,max_mem=2048,
"sriov_eth_logical_ports=""adapter_id=2:phys_port_id=0:allowed_vlan_ids=101,102"""" (with vlan list)

7. Change System Resources (chsycfg)

Set:

chsycfg -r prof -m astrosfsp1 -i
 "lpar_id=11,name=prof5,""sriov_eth Logical_ports=""adapter_id=2:phys_port_id=0:allowed_vlan_ids=101,102"""

Add:

chsycfg -m mysystem -r prof -i “name=profile1, lpar_name=lpar1,
sriov_eth Logical_ports+=adapter_id=1:phys_port_id=1”

Remove:

chsycfg -m mysystem -r prof -i “name=profile1, lpar_name=lpar1,
sriov_ethLogical_ports-=config_id=2”
Notes on Performance testing
Performance Tests

- **Information on testing**
  - ATS US team performed 1 Gb tests (10Gb pending)
    - Shared environment with AIX & Linux on PowerVM
    - Allyn Walsh, Sue Baker, Steve Nasypany
    - 9179-MHD, 4.4 GHz, AM780 test levels
  - IBM Germany performed 10Gb tests
    - Shared environment on PowerVM, dedicated and shared adapter
    - Dr. Martin Springer and Alexander Paul
    - 9117-MMD, 3.8 GHz, v7.7.9 HMC, AM780 test levels
  - Both teams used the iperf tool for parallel/multi-session tests
    - Server command: `iperf -s`
    - Client(s) command: `iperf -c [server] -P [#sessions] -t [secs]`
Performance Guidance

- **Guidance with customer tests**
  - Use iperf and always use parallel tests
  - Presume when customers complain about 10 Gb SEA, they need tuning
    - If migrating/deploying to 10 Gb SEA, customers need education
    - Ask for ATS Steve Knudson’s *Ethernet on Power* webinar
  - When customers complain about Virtual Ethernet Switch or SR-IOV performance
    - “I just did an FTP on my PC and I get 5 Gb/s, but AIX only gives me 3 Gb/s!”
    - Presume that they are performing single-stream test (ftp, etc)
    - These IBM offerings are not intended to provide single-stream 10 Gb/s performance. They are designed for efficiency for multi-stream environments first. We cannot get you to 10Gb/s @ MTU 1500 for a single ftp stream.
10 Gb Performance

- **Observations on traditional SEA 10Gb performance**
  - Cannot reach line speeds w/o tuning
  - Requires use of large receive/send (not supported on Linux), mtu_bypass tuning on client, multiple streams and/or MTU 9000
  - Single stream MTU 1500 best case is usually ~4 Gb/s
  - Two to three POWER7 cores required to reach 9 Gb/s bandwidth

- **SR-IOV general performance statement**
  - SR-IOV provides a better out-of-box performance than SEA with 10Gb
    - Much lower CPU usage at or below 8 Gb/sec at MTU 1500 or 9000
    - CPU utilization and throughput equivalent to Virtual Switch with MTU 64K
  - 1 Gb dedicated or SEA environments are rarely problematic, but
    - SR-IOV uses significantly lower CPU resources
    - SR-IOV offers capacity controls otherwise not available
  - **SR-IOV provides the performance of a dedicated adapter with the flexibility of SEA plus capacity controls**
1 Gb SR-IOV

- 1 Gb tests performed by ATS US
  - No apparent dependency on MTU 1500 vs 9000, very similar results
  - 1 Gb/s client consumed ~0.2 vs ~0.6 physc SEA at MTU 1500

- Testing of capacity adjustments
  - Capacity changes are made in 2% increments
  - A variety of ranges were tested, actual enforcement is not strict
    - 50:50 capacity settings yielded 1:1 ratios (~470 Mb/s per client)
    - 80:20 yielded 3-4:1 throughput ratios (720:220 Mb/s)
    - 90:10 yielded 7-8:1 throughput ratios (830:110 Mb/s)
  - Generally have to drive higher parallel clients sessions (12 or more) to saturate each client and get reasonable capacity comparisons
  - Customers with variable workloads may find it hard to see exact capacity enforcement. Levelset expectations that enforcement becomes stricter as driver/adapter is saturated. If bandwidth is available, SR-IOV will not throw it away to enforce capacity setting.
10 Gb SR-IOV

- **10 Gb SR-IOV tests performed by IBM Germany**
  - No dependency on MTU 1500 vs 9000, very similar results
  - 5 Gb/s client 0.5 to 0.6 physical consumed
  - 8 Gb/s client 1.0 to 1.1 physical consumed
  - Results correspond to dedicated adapter best-case expectations

- **Virtual Ethernet Switch Comparisons**
  - SR-IOV significantly out-performed Virtual Ethernet at MTU 1500 & 9000
    - Required 0.5 to 1.0 physc from 4 to 7 Gb/s
    - Generally, 1/3 to ¼ the client CPU for MTU 1500
    - ½ client CPU for MTU 9000
  - SR-IOV with MTU 1500 performed similarly to Virtual Ethernet MTU 64K
    - Up to 10 Gb/s @ 1.5 physc
    - VENT at 64K can actually exceed 10 Gb/s, real adapters cannot
SR-IOV MTU 9000 Configuration

- **Configuring MTU requires**
  - Hardware Information -> Adapters -> SR-IOV End-to-End Mapping
  - SR-IOV Device Mappings
    - Select Converged Ethernet Physical Port profile under Physical Port
    - Select Configure Logical Ports profile
    - Physical Port Property -> Advanced -> MTU Size = 1500 | 9000
  - On clients
    - `rmdev -l en*`
    - `chdev -l ent* -a jumbo_frames=yes`
    - `cfgmgr -vI en*`
    - `chdev -I en* -a mtu=9000`

- **Given that SR-IOV performance is very good at MTU 1500, I would not bother configuring to the higher MTU unless the customer environment is already set up for 9000.**
Additional information

- Bookmark the appropriate page for future and past webcasts
  - IBMers: http://w3.ibm.com/sales/support/ShowDoc.wss?docid=SGDH587972A30633A38&node=brands,B5000|brands,B5Y00|clientset,IA
  - Partners: http://www.ibm.com/partnerworld/wps/servlet/ContentHandler/SGDH587972A30633A38

- Redpaper:
  - IBM Power Systems SR-IOV Technical Overview and Introduction

- Developerworks:

- Hardware Information center
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