vNIC Tutorial

System x

IBM BladeCenter vNIC tutorial

How to configure Virtual NICs using the Emulex Virtual Fabric Adapter and BNT Virtual Fabric Switch Module

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Content

Figures

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Introduction

This tutorial is intended as a 'how-to' guide for configuring BladeCenter Virtual NIC (vNIC) operation using the Emulex Virtual Fabric Adapter (VFA) and the Blade Network Technologies (BNT) Virtual Fabric Switch Module (VFS).

For the initial release of vNIC functionality for BladeCenter, configuration is accomplished using the standard management interfaces of the VFS. This guide describes implementation examples for both the Command Line Interface (CLI) and the Browser-Based Interface (BBI).

Hardware/Firmware Required:

- Emulex Virtual Fabric Adapter (49Y4235)
- BNT Virtual Fabric Switch Module for IBM BladeCenter (46C7191) with firmware build 6.1.1 or later.

It is strongly recommended that the reader of this tutorial become familiar with BladeCenter VNIC functionality by referring to the section entitled, "Virtual NICs", in the *BNT Virtual Fabric 10Gb Switch Module for IBM BladeCenter, Application Guide* (see Related Documentation on p.41).

Getting Started

This tutorial assumes basic familiarity with BladeCenter virtual NIC (vNIC) functionality as implemented by the Emulex Virtual Fabric Adapter (VFA) and the BNT Virtual Fabric Switch Module (VFS).

General characteristics of this functionality are:

- Each Server physical NIC (pNIC) port is divided into 4 virtual NICs (vNICs)
- OS configurations see eight unique NICs (2 ports X 4 vNICs)
- All vNIC parameters are configured from the VFS user interface
    - DCBX protocol is used between switch and NIC to convey configuration information
- User enables vNICs and allocates bandwidth
    - Allowable vNIC bandwidth range is 100Mbps-10Gbps
        - increments of 100Mbps
        - default bandwidth setting is 2.5Gbps
        - the sum of all 4 vNICs cannot exceed 10Gbps
    - VFS to Server bandwidth metering on per vNIC per port basis
    - Server to VFS bandwidth metering on per vNIC basis
- User assigns vNIC(s) and, optionally, uplink(s) to vNIC groups
    - groups serve to isolate virtual NIC traffic flowing on the same physical port
        - existing VLANs within the customer network are not impacted
        - no forwarding occurs between uplinks assigned to vNIC groups
        - up to 32 vNIC groups supported per VFS
        - an uplink (port or trunk) can belong to only one vNIC group
        - a server port (pNIC or vNIC) can belong to only one vNIC group
    - failover mechanism is virtual port aware

Basic Setup

Virtual Fabric Adapter (VFA) Configuration

The Emulex Virtual Fabric Adapter for IBM BladeCenter (VFA) can operate in 10Gb dual 4-port Virtual Ethernet mode (vNIC) or 10Gb dual Port Ethernet mode (pNIC). The VFA default mode is set to vNIC.

vNIC mode is enumerated by the Operating System or Hypervisor as 8 separate Ethernet devices (4 per physical port). The pNIC mode can be enabled per the instructions in the *Installation and User's Guide for Emulex Virtual Fabric Adapter (CFFh)*.

There are two 10Gb Ethernet switch environments supported, depending on the VFA mode:

- **vNIC mode (default)**: The VFA must be paired with one or two BNT Virtual Fabric 10Gb Switch Modules (VFS) to operate. To enable VFA (virtual) Ethernet connections, the VFS must be configured for vNIC mode. The VFS configuration parameters control the speed of the individual vNIC links (in increments of 100 Mbps) and assign a collection of vNIC links to common communication groups. Unused vNIC links can be disabled. Refer to *vNIC/pNIC Configuration Possibilities* (p.10).

- **pNIC mode**: The VFA functions as a 10 Gb dual port Ethernet device and can be paired with any high speed IBM BladeCenter 10Gb Ethernet/CEE (HSSM). This includes VFS and non virtual fabric 10Gb Ethernet switches or pass-thru modules. No additional HSSM configuration is required when the VFA is set to operate in this mode.

Other than mode selection, the VFA has no configuration requirement for virtual NIC operation.

Virtual Fabric Switch (VFS) Configuration

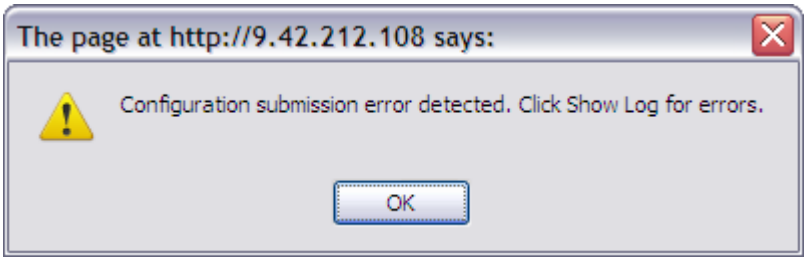
Three basic steps are required in order to permit vNIC operation between the VFA and the VFS.

1. Enable vNIC operation on the applicable blade ports
2. Customize the maximum bandwidth for each vNIC (optional)
3. Group the vNIC links into common communication groups

NOTE: if an attempt is made to enable vNIC operation on a blade port that is not capable, a warning message similar to the following is displayed on the switch Command Line Interface (CLI) and added to the switch log.

```
Warning: Peer does not support vNIC on port INT11
```

Note: if you are using the switch Browser-Based user interface (BBI), the following popup is given to alert you to this warning message.



VFA/VFS vNIC Correlation

Setting up virtual connections requires an understanding of how the adapter and switch identifies the eight (8) possible vNIC devices. Table 1 illustrates the designations used.

VFA		VFS		
PCIe Function ID	Port	I/O Bay	Port Alias (Blade slot x)	vNIC
0	0	7	INTx.1	1
2	0	7	INTx.2	2
4	0	7	INTx.3	3
6	0	7	INTx.4	4
1	1	9	INTx.1	1
3	1	9	INTx.2	2
5	1	9	INTx.3	3
7	1	9	INTx.4	4

Table 1 - VFA/VFS vNIC Correlation table

Note: For the VFA, the PCIe Function ID can be determined by running the 'ethtool -i' command in Linux, or by viewing the Network Adapter Properties in Windows Device Manager.

What is Failover ?

When external VFS uplinks are part of a vNIC group, this feature allows the state of the external connection to directly influence the link state of all internal ports (vNICs and pNICs) which are members of the group.

When triggered, the failover mechanism operates on a 'per vNIC group' basis, thus not affecting vNICs/NICs which have no association with the failed uplink. Virtual connections within the group are disabled without bringing down the internal physical port (Refer to Case 4 for configuration example).

Note: Refer to the *BNT Virtual Fabric 10Gb Switch Module for IBM BladeCenter, Application Guide* for a detailed explanation of how/why Failover is used during vNIC operation.

vNIC/pNIC Configuration Possibilities

The basic matrix of vNIC group possibilities is identified by considering the possible NIC types (physical, virtual) and uplink types (port, trunk). Table 2 enumerates the choices.

Case	Uplink Trunk	Single Uplink	Phys NIC	Virt NIC	Comments
1				■	vNICs only, No Uplinks (see p.12)
2			■	■	vNICs and pNICs, No uplinks (see p.16)
3		■		■	vNICs only, One uplink (see p.21)
4		■	■	■	vNICs and pNICs, One uplink (w/failover) (see p.25)
5	■			■	vNICs only, One uplink trunk (see p.30)
6	■		■	■	vNICs and pNICs , One uplink trunk (see p.35)
7*			■		pNICs only, no uplinks
8*		■	■		pNICs only, one uplink
9*	■		■		pNICs only, one uplink trunk

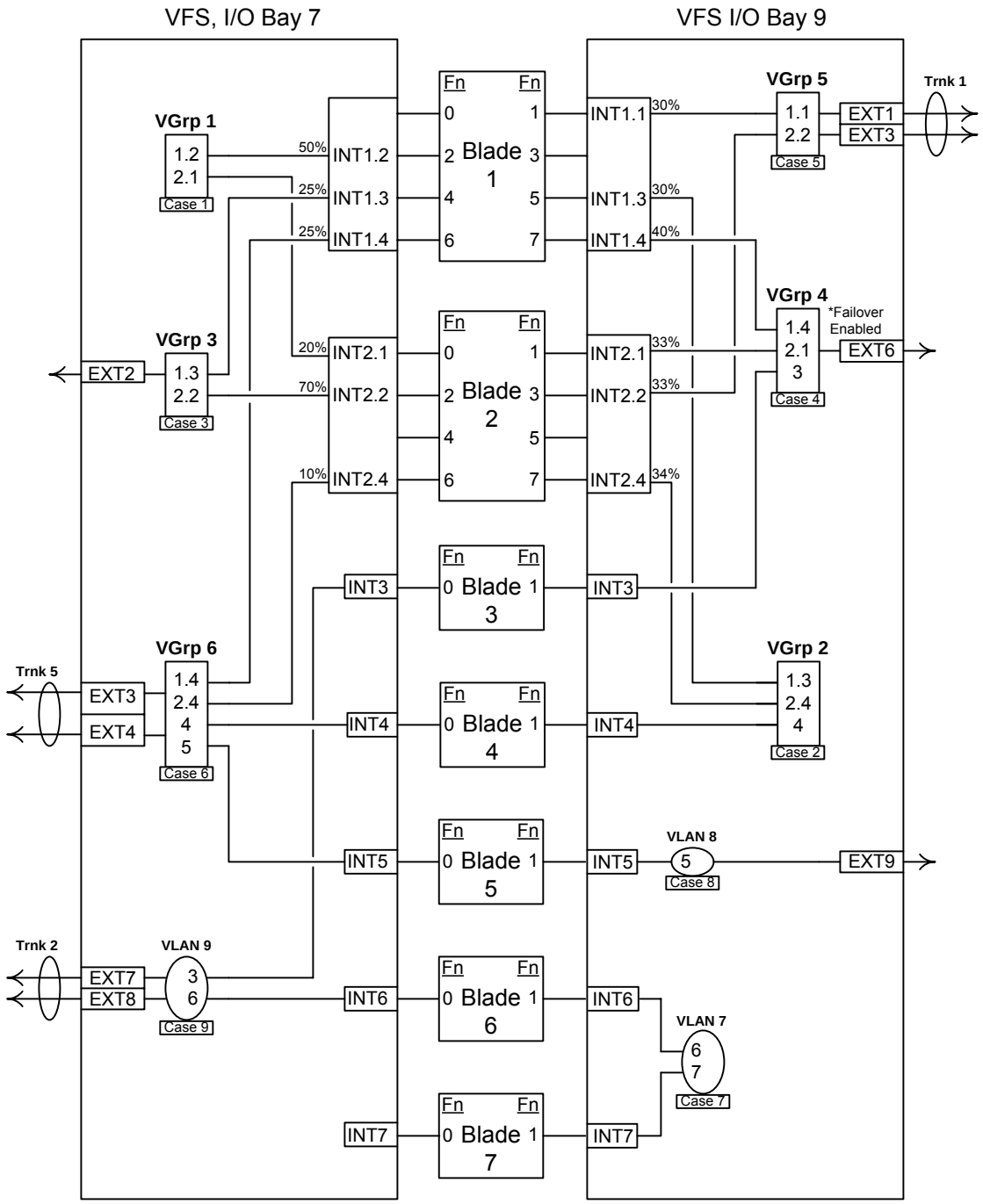
Table 2 : Combinations Matrix

Note: Cases 7-9, though permitted as vNIC groups, are typically handled by traditional VLAN configuration and are therefore not covered by this tutorial. They are included in the table for completeness.

Each of the configuration possibilities are depicted in Figure 1 on p.11. The actions required to implement Cases 1-6 are detailed in subsequent sections.

Note: For switch CLI users, script files ("VFS-vnic-scripts.zip") are available which can be used to configure the vNIC groups depicted in Figure 1. See the `/cfg/gtcfg` command in the *BNT Virtual Fabric 10Gb Switch Module for IBM BladeCenter, Command Reference* for instructions on loading these scripts via FTP or TFTP. Alternately, the configuration text can be copied and pasted directly into the CLI session.

Figure 1 – Typical vNIC Configuration Scenarios



Case 1 - vNICs only, No Uplinks

Represented as VGRP 1 in Figure 1 on p.11, this group consists solely of vNIC ports.

Switch CLI

The following command script can be used to implement this configuration.

```
/c/virt/vnic
        on
/c/virt/vnic/port INT1/vnic 2
        ena
        bw 50
/c/virt/vnic/port INT2/vnic 1
        ena
        bw 20
/c/virt/vnic/vnicgrp 1
        ena
        vnicvlan 127
        addvnic INT1.2
        addvnic INT2.1
apply
```

Switch BBI

Click on the 'Configure' tab, then perform the following sequence of web interface entries to implement this configuration.

1. Enable vNIC operation. (Submit, Apply … and Save, if you want it to persist after switch reboot.)

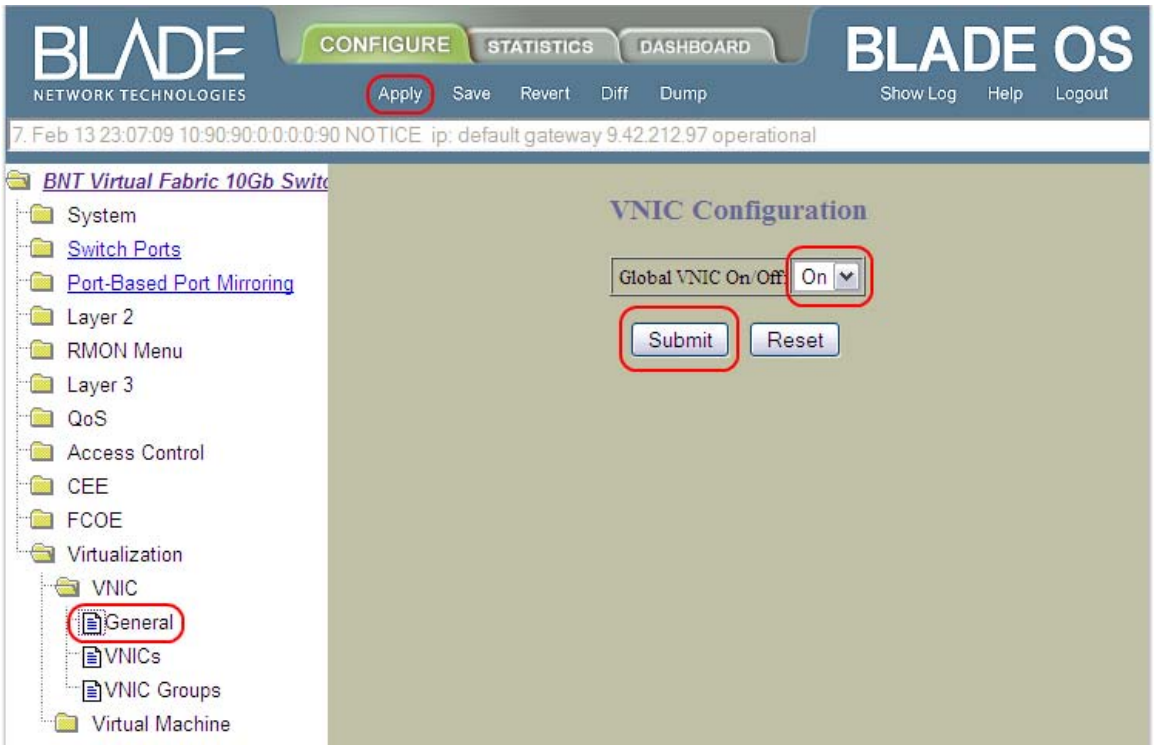


Figure 2 - BBI : Case 1, Enable vNIC operation

2. Enable and configure vNICs (remember to Submit and Apply).

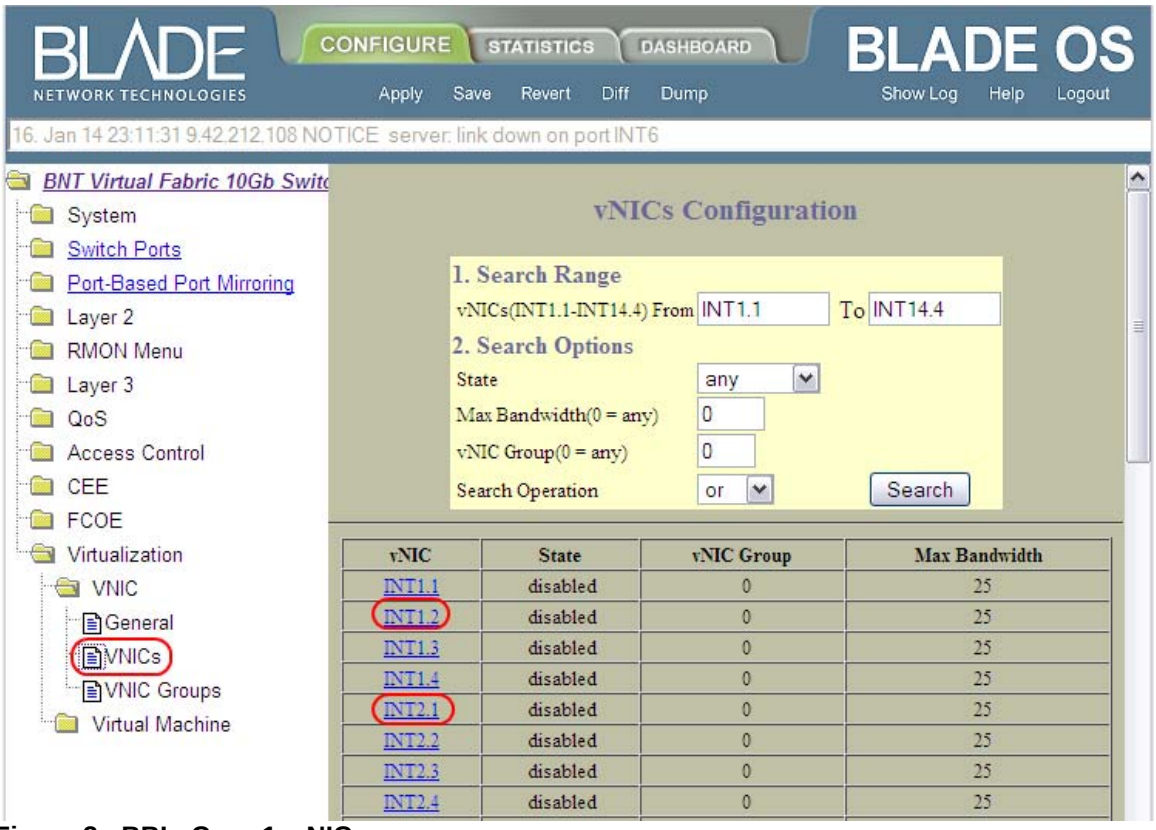


Figure 3 - BBI : Case 1, vNICs pane

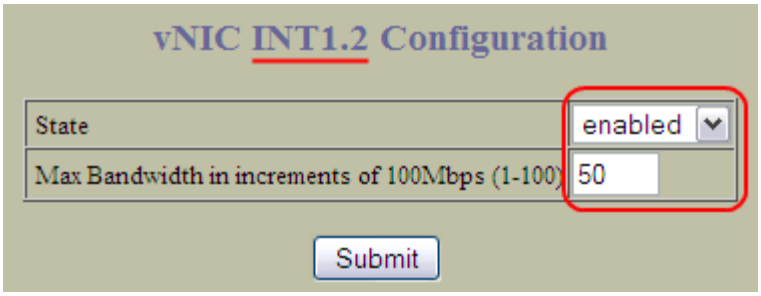


Figure 4 - BBI : Case 1, vNIC INT1.2 Configuration

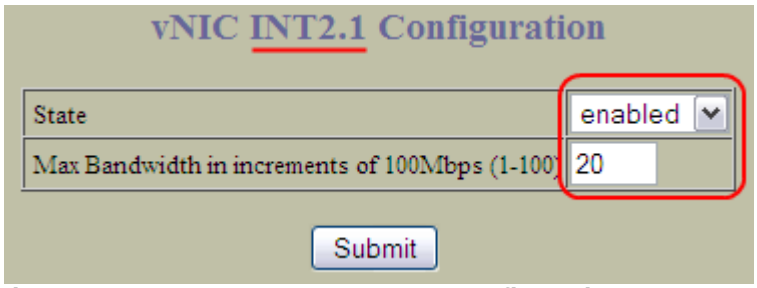


Figure 5 - BBI : Case 1, vNIC INT2.1 Configuration

3. Enable and configure the vNIC group.

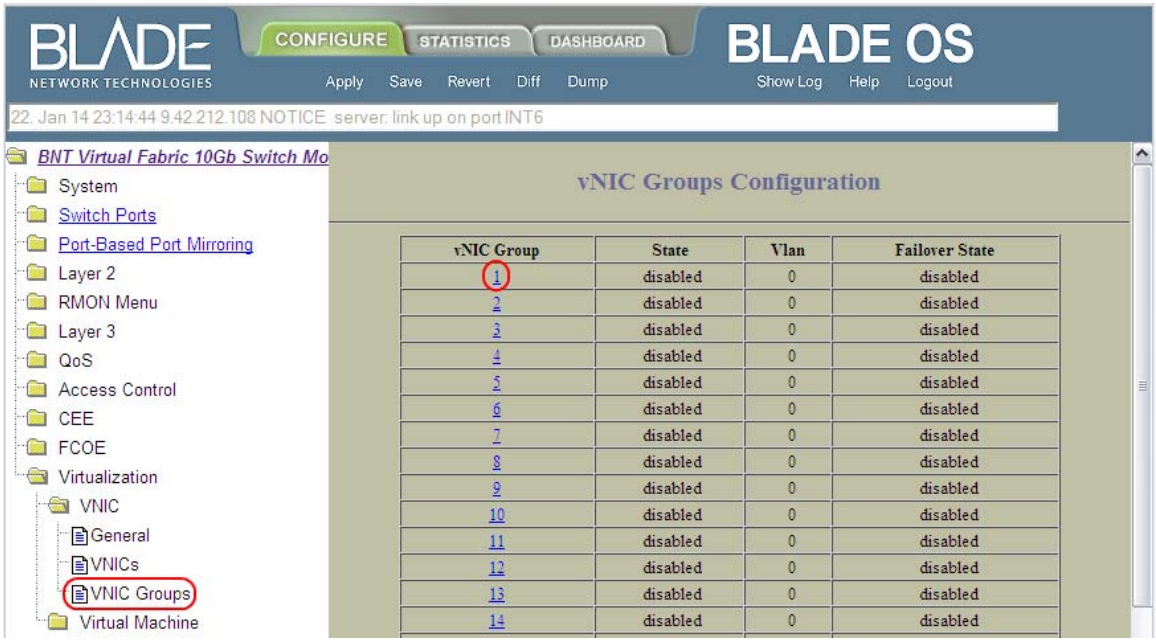


Figure 6 - BBI : Case 1, vNIC Groups pane

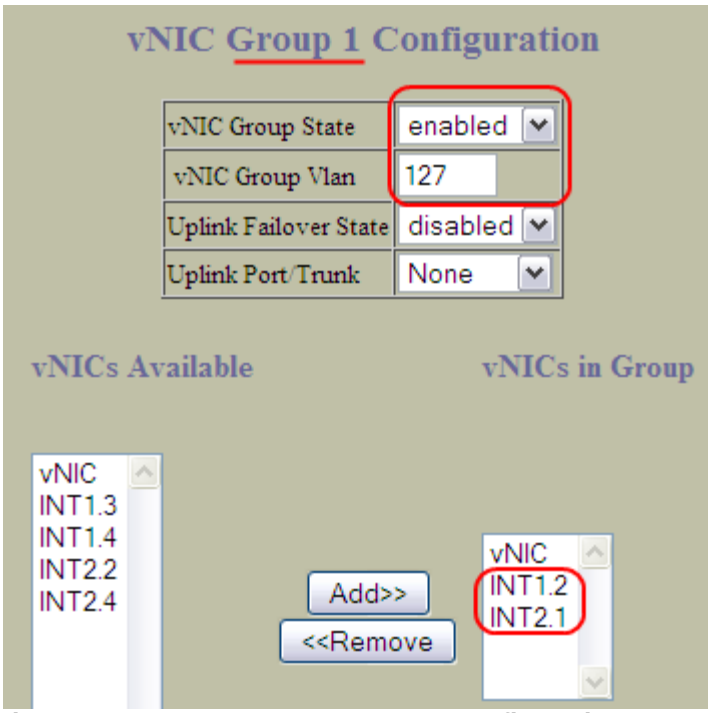


Figure 7 - BBI : Case 1, vNIC Group Configuration

Case 2 - vNICs and pNICs, No uplinks

Represented as VGRP 2 in Figure 1 on p.11, this group consists of vNIC and pNIC ports, but no uplink ports.

Switch CLI

The following command script can be used to implement this configuration.

```
/c/virt/vnic
        on
/c/virt/vnic/port INT1/vnic 3
        ena
        bw 30
/c/virt/vnic/port INT2/vnic 4
        ena
        bw 34
/c/virt/vnic/vnicgrp 2
        ena
        vnicvlan 310
        addvnic INT1.3
        addvnic INT2.4
        addport INT4
apply
```

Switch BBI

Click on the 'Configure' tab, then perform the following sequence of web interface entries to implement this configuration.

1. Enable vNIC operation. (Submit, Apply … and Save, if you want it to persist after switch reboot.)

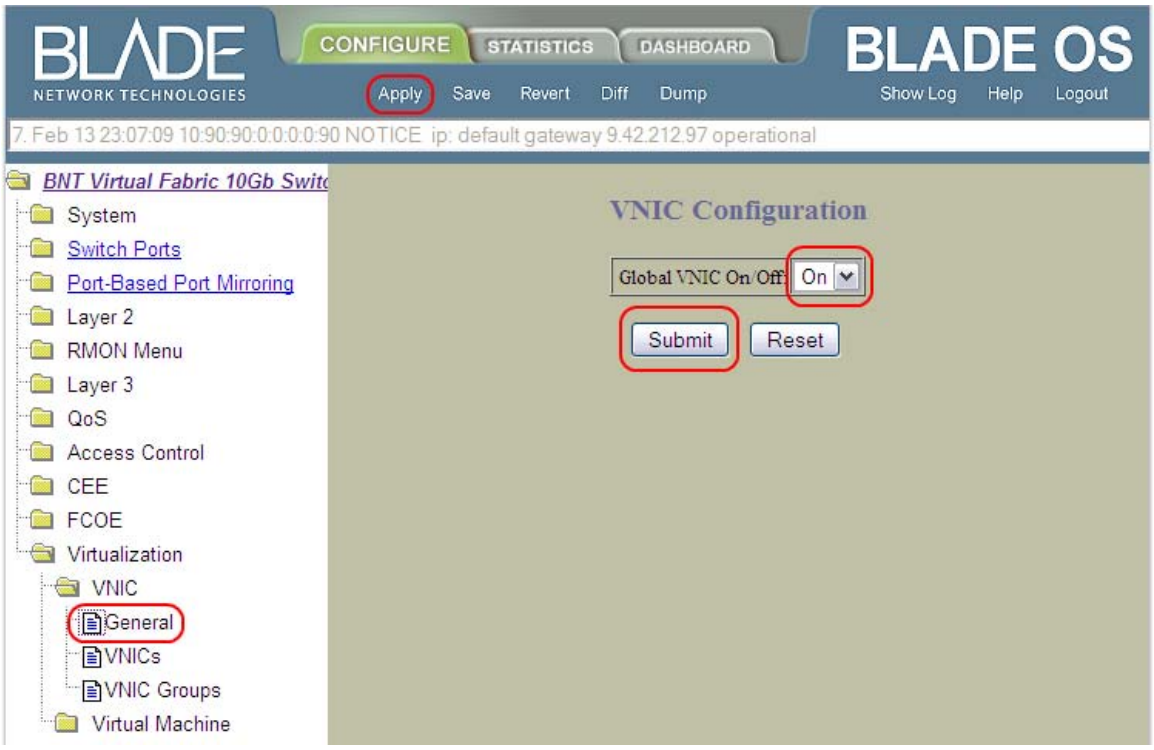


Figure 8 - BBI : Case 2, Enable vNIC operation

2. Enable and configure vNICs (remember to Submit and Apply).

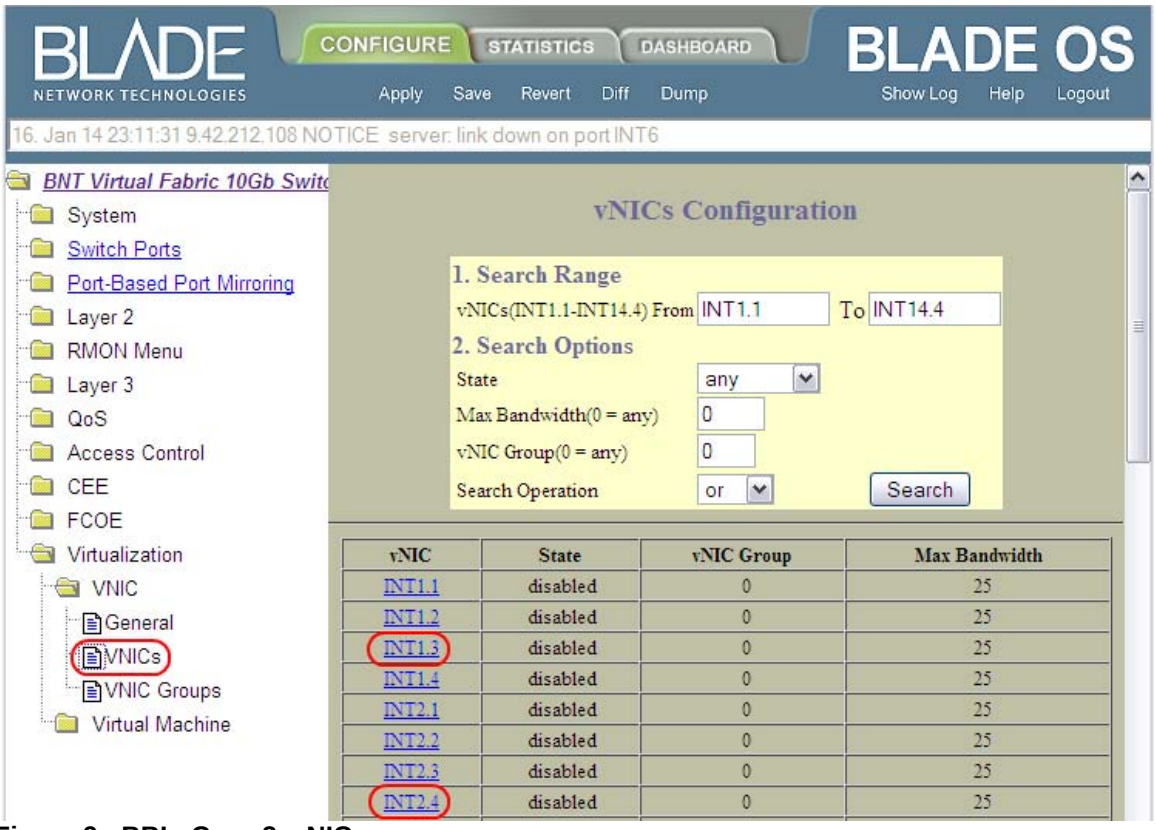


Figure 9 - BBI : Case 2, vNICs pane

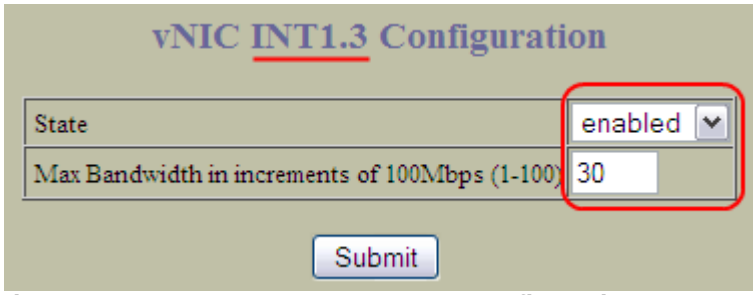


Figure 10 - BBI : Case 2, vNIC INT1.3 Configuration

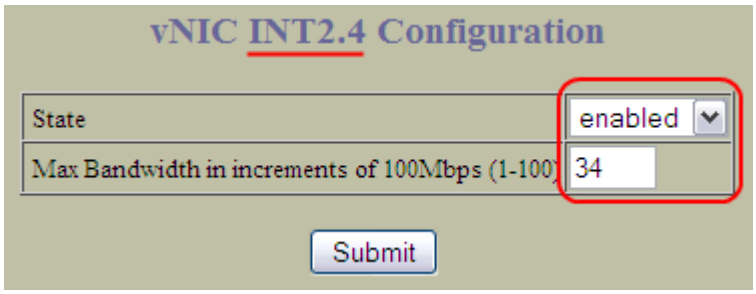


Figure 11 - BBI : Case 2, vNIC INT2.4 Configuration

3. Enable and configure the vNIC group.

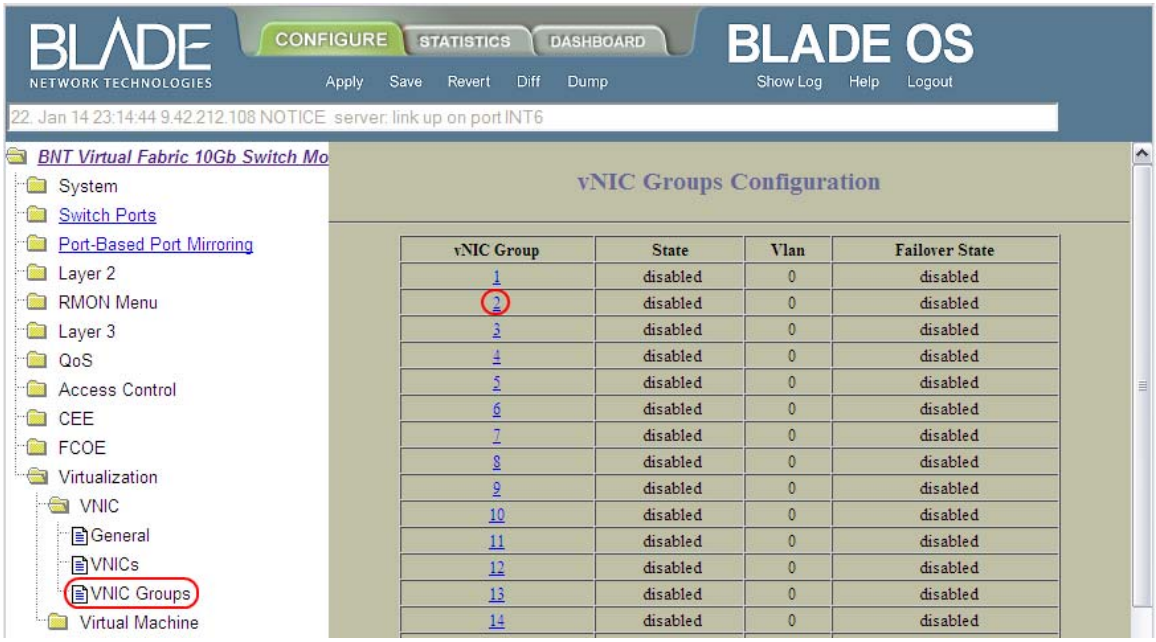


Figure 12 - BBI : Case 2, vNIC Groups pane

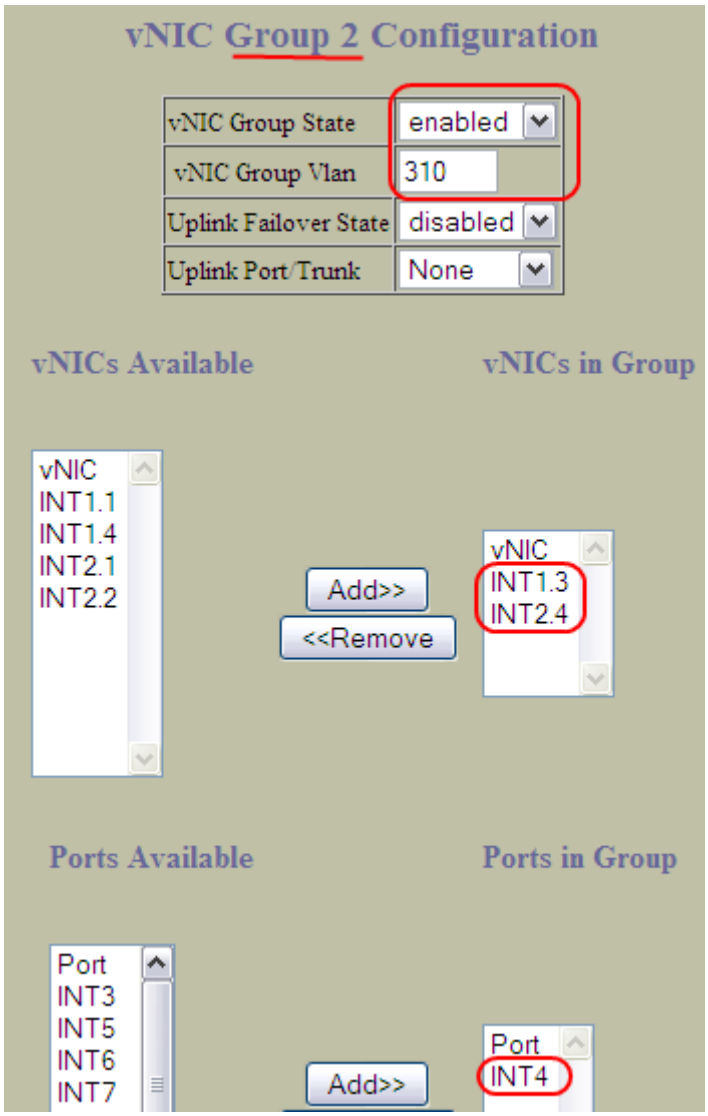


Figure 13 - BBI : Case 2, vNIC Group Configuration

Case 3 - vNICs only, One uplink port

Represented as VGRP 3 in Figure 1 on p.11, this group consists of vNIC ports and one uplink port.

Switch CLI

The following command script can be used to implement this configuration.

```
/c/virt/vnic
        on
/c/virt/vnic/port INT1/vnic 3
        ena
        bw 25
/c/virt/vnic/port INT2/vnic 2
        ena
        bw 70
/c/virt/vnic/vnicgrp 3
        ena
        vnicvlan 500
        addvnic INT1.3
        addvnic INT2.2
        addport EXT2
apply
```

Switch BBI

Click on the 'Configure' tab, then perform the following sequence of web interface entries to implement this configuration.

1. Enable vNIC operation. (Submit, Apply … and Save, if you want it to persist after switch reboot.)

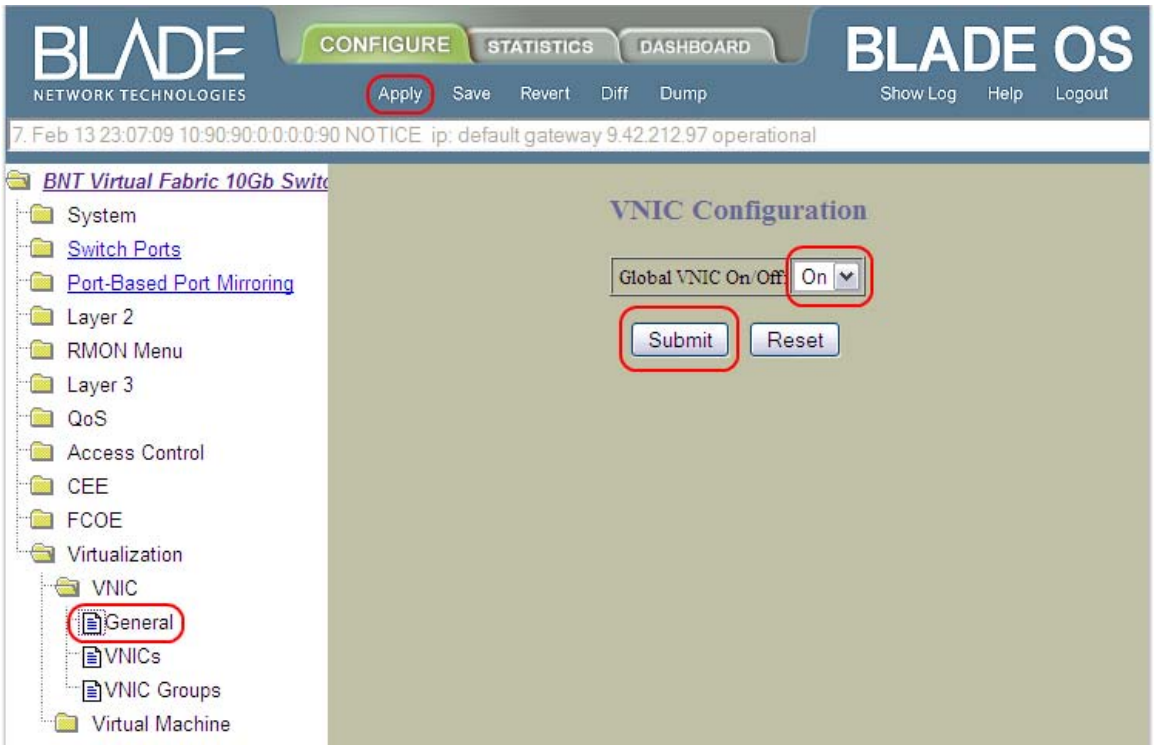


Figure 14 - BBI : Case 3, Enable vNIC operation

2. Enable and configure vNICs (remember to Submit and Apply).

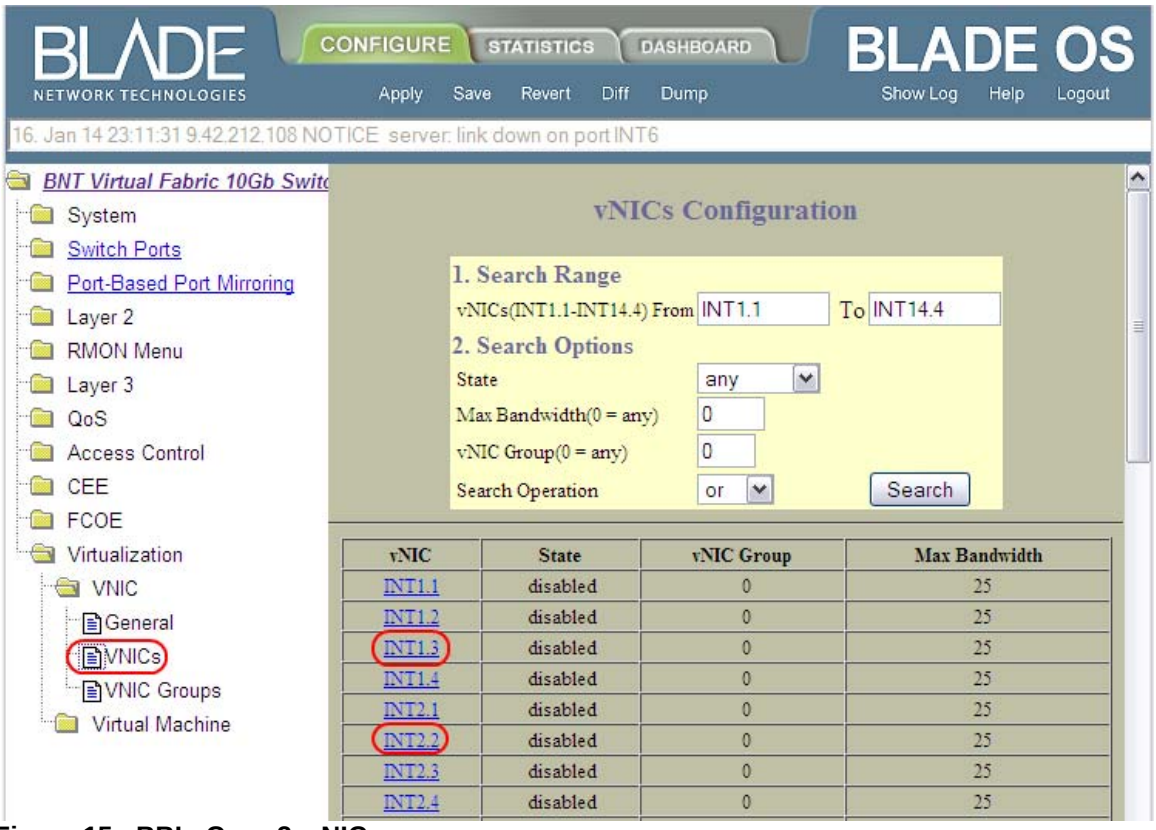


Figure 15 - BBI : Case 3, vNICs pane

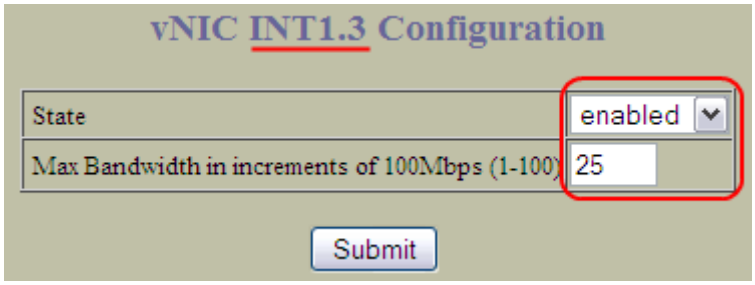


Figure 16 - BBI : Case 3, vNIC INT1.3 Configuration

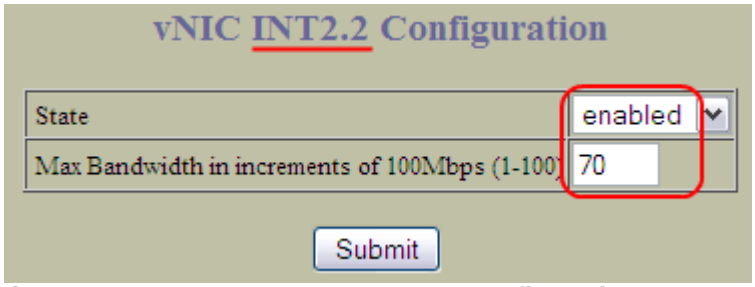


Figure 17 - BBI : Case 3, vNIC INT2.2 Configuration

3. Enable and configure the vNIC group.

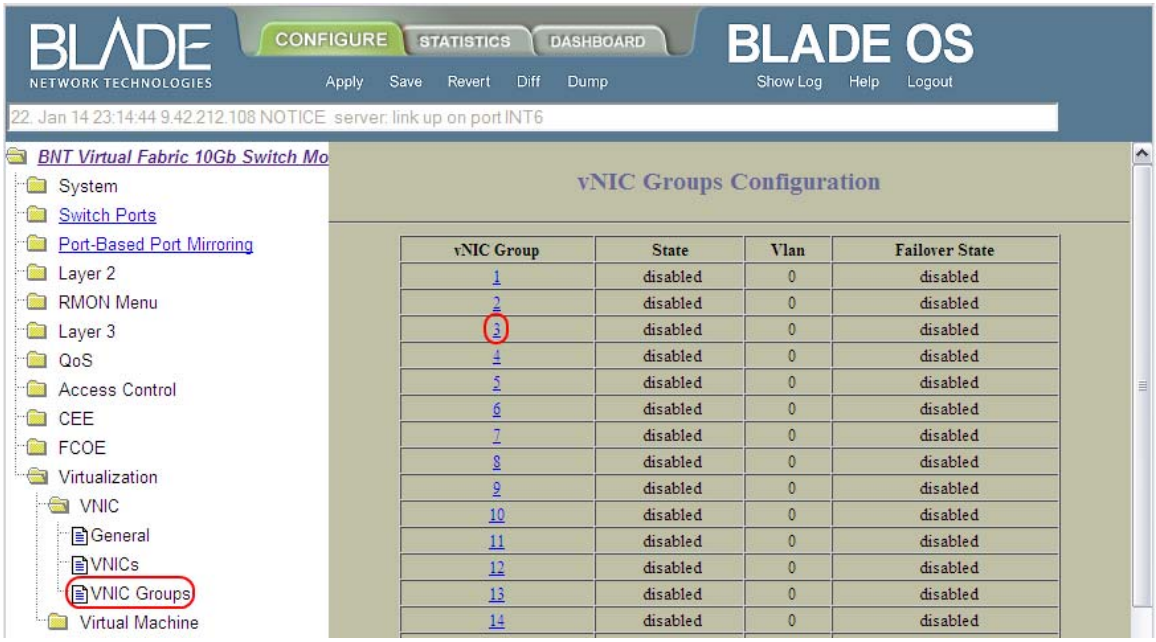


Figure 18 - BBI : Case 3, vNIC Groups pane

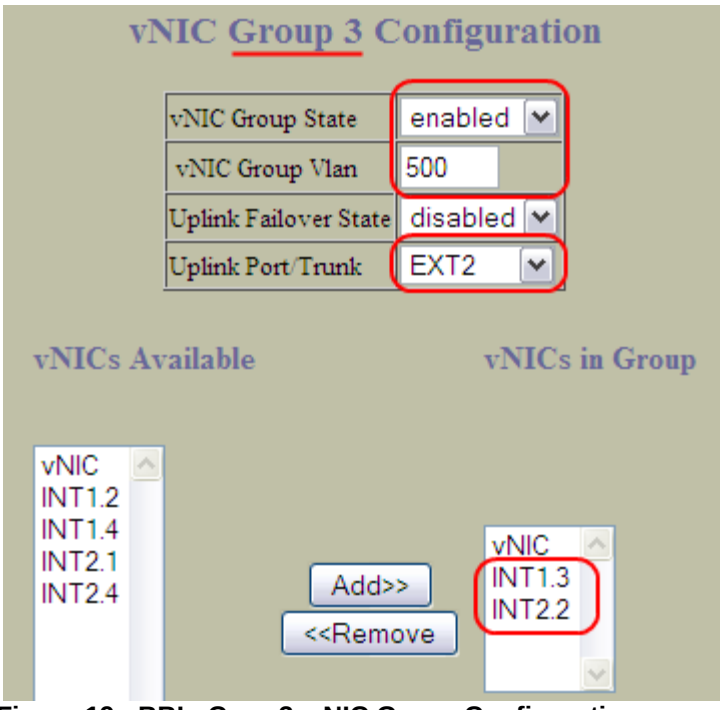


Figure 19 - BBI : Case 3, vNIC Group Configuration

Case 4 - vNICs and pNICs, One uplink port (w/failover)

Represented as VGRP 4 in Figure 1 on p.11, this group consists of vNIC and pNIC ports, and one uplink port.

Failover is enabled for this group, so if the link on EXT6 is disrupted, the VFS disables virtual ports INT1.4, INT2.1 and physical port INT3. This action facilitates NIC team failover on the server blade.

Switch CLI

The following command script can be used to implement this configuration.

```
/c/virt/vnic
        on
/c/virt/vnic/port INT1/vnic 4
        ena
        bw 40
/c/virt/vnic/port INT2/vnic 1
        ena
        bw 33
/c/virt/vnic/vnicgrp 4
        ena
        vnicvlan 727
        failover ena
        addvnic INT1.4
        addvnic INT2.1
        addport INT3
        addport EXT6
apply
```

Switch BBI

Click on the 'Configure' tab, and then perform the following sequence of web interface entries to implement this configuration.

1. Enable vNIC operation. (Submit, Apply … and Save, if you want it to persist after switch reboot.)

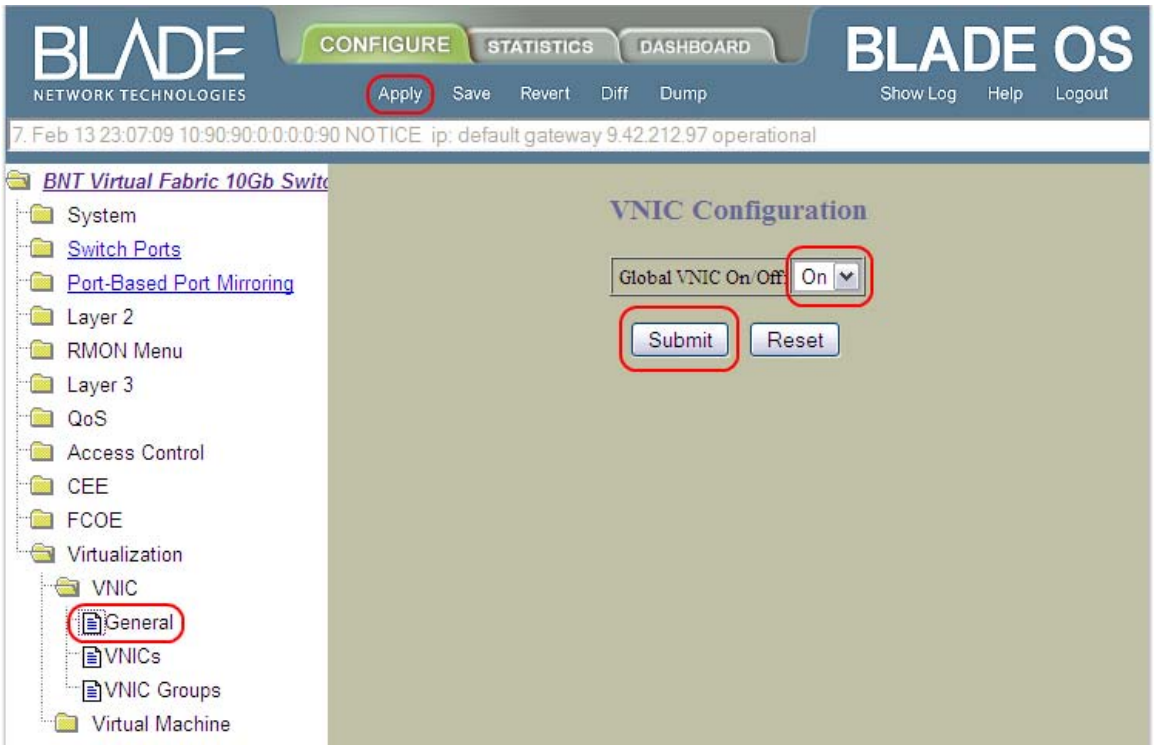


Figure 20 - BBI : Case 4, Enable vNIC operation

2. Enable and configure vNICs (remember to Submit and Apply).

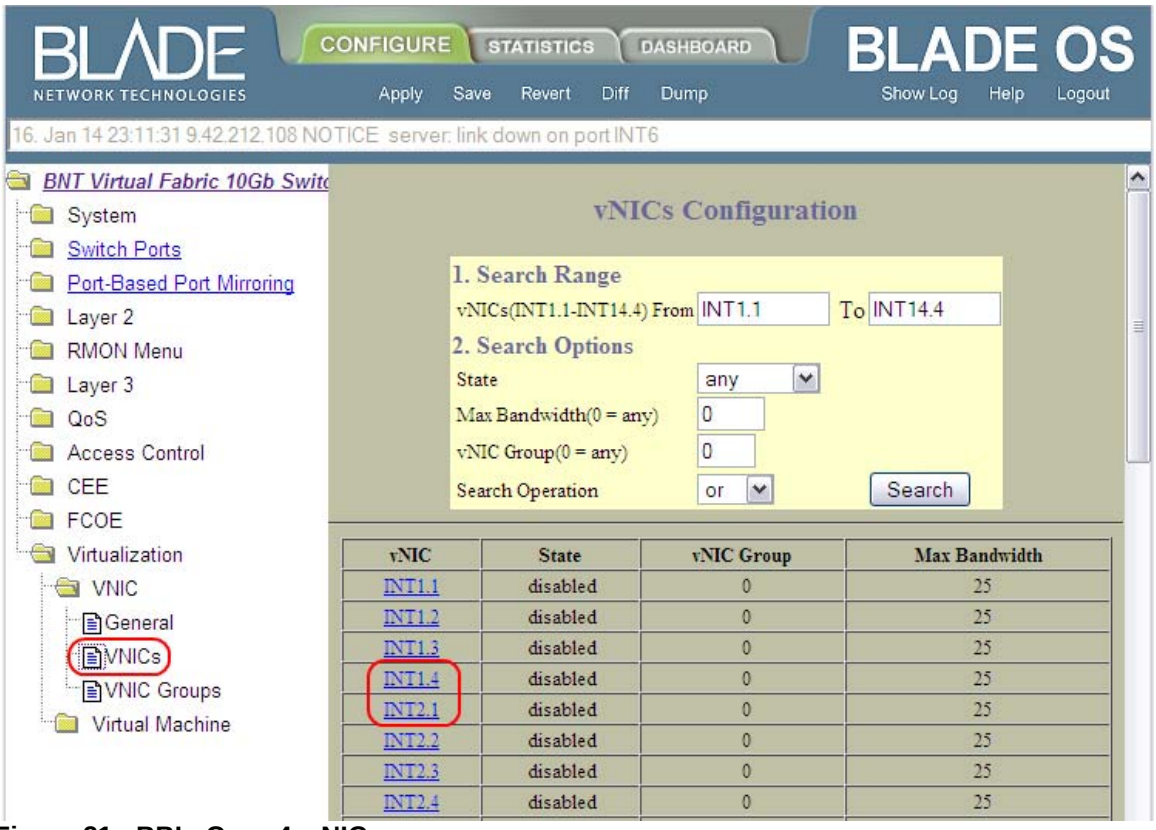


Figure 21 - BBI : Case 4, vNICs pane

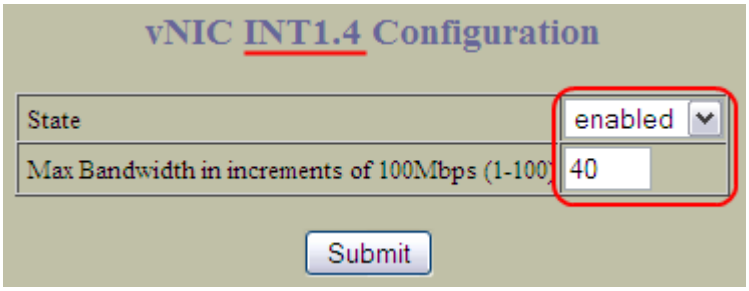


Figure 22 - BBI : Case 4, vNIC INT1.4 Configuration

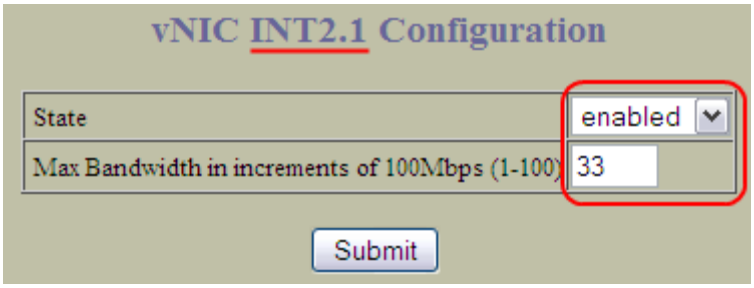


Figure 23 - BBI : Case 4, vNIC INT2.1 Configuration

3. Enable and configure the vNIC group.

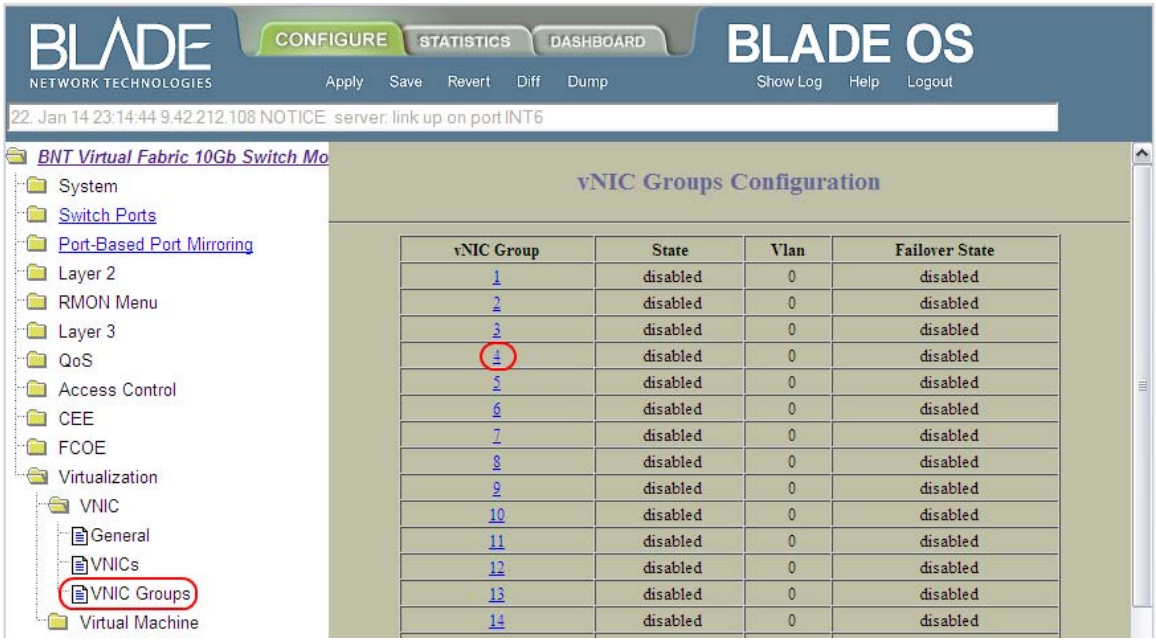


Figure 24 - BBI : Case 4, vNIC Groups pane

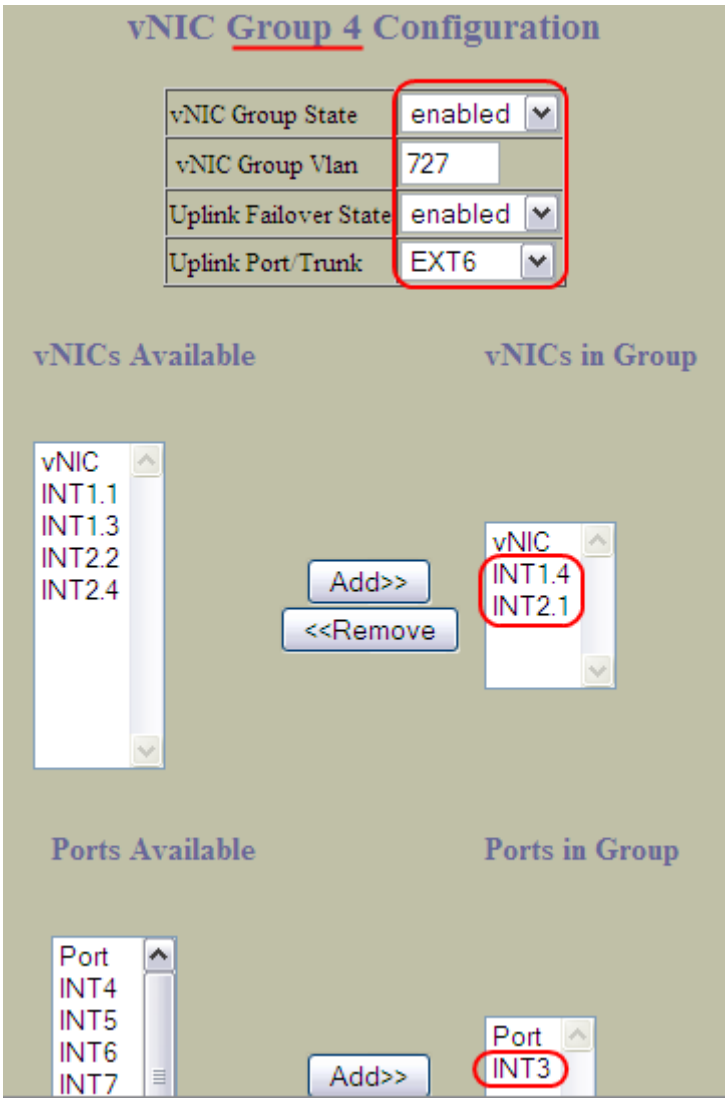


Figure 25 - BBI : Case 4, vNIC Group Configuration

Case 5 - vNICs only, One uplink trunk

Represented as VGRP 5 in Figure 1 on p.11, this group consists of vNIC ports and one uplink trunk.

Switch CLI

The following command script can be used to implement this configuration.

```
/c/l2/trunk 1
        ena
        add EXT1
        add EXT3
/c/virt/vnic
        on
/c/virt/vnic/port INT1/vnic 1
        ena
        bw 30
/c/virt/vnic/port INT2/vnic 2
        ena
        bw 33
/c/virt/vnic/vnicgrp 5
        ena
        vnicvlan 925
        addvnic INT1.1
        addvnic INT2.2
        addtrnk 1
apply
```

Switch BBI

Click on the 'Configure' tab, then perform the following sequence of web interface entries to implement this configuration.

1. Enable vNIC operation. (Submit, Apply … and Save, if you want it to persist after switch reboot.)

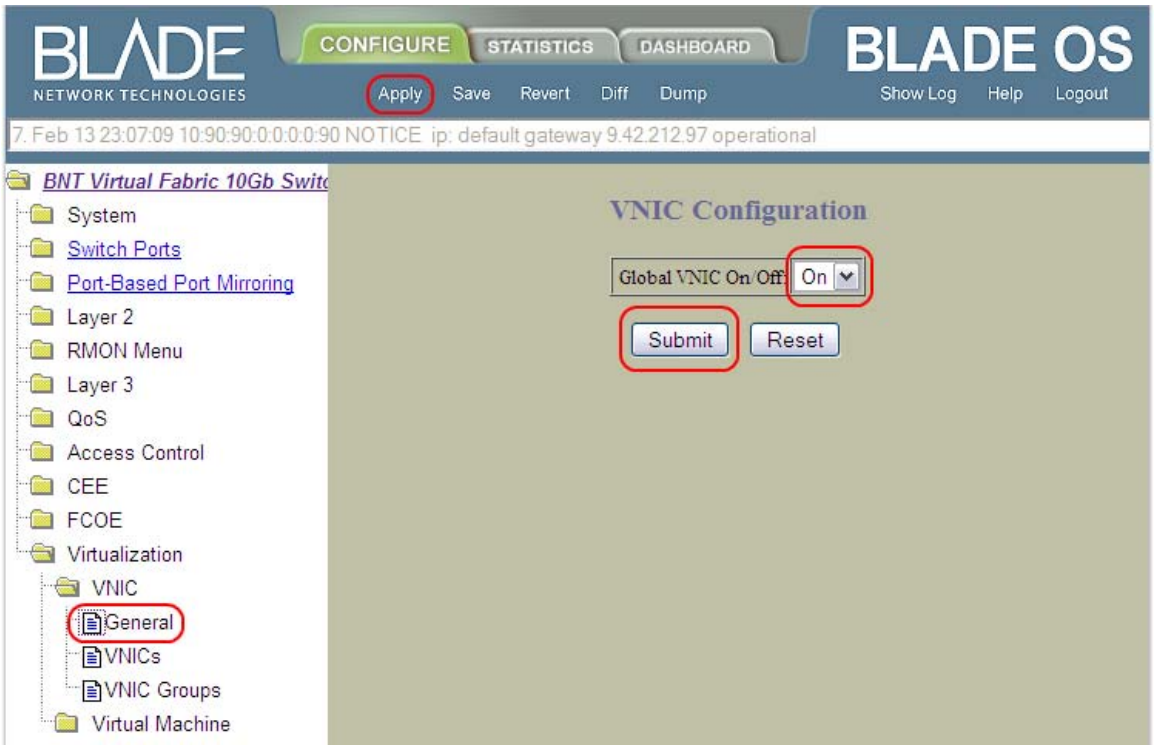


Figure 26 - BBI : Case 5, Enable vNIC operation

2. Enable and configure vNICs (remember to Submit and Apply).

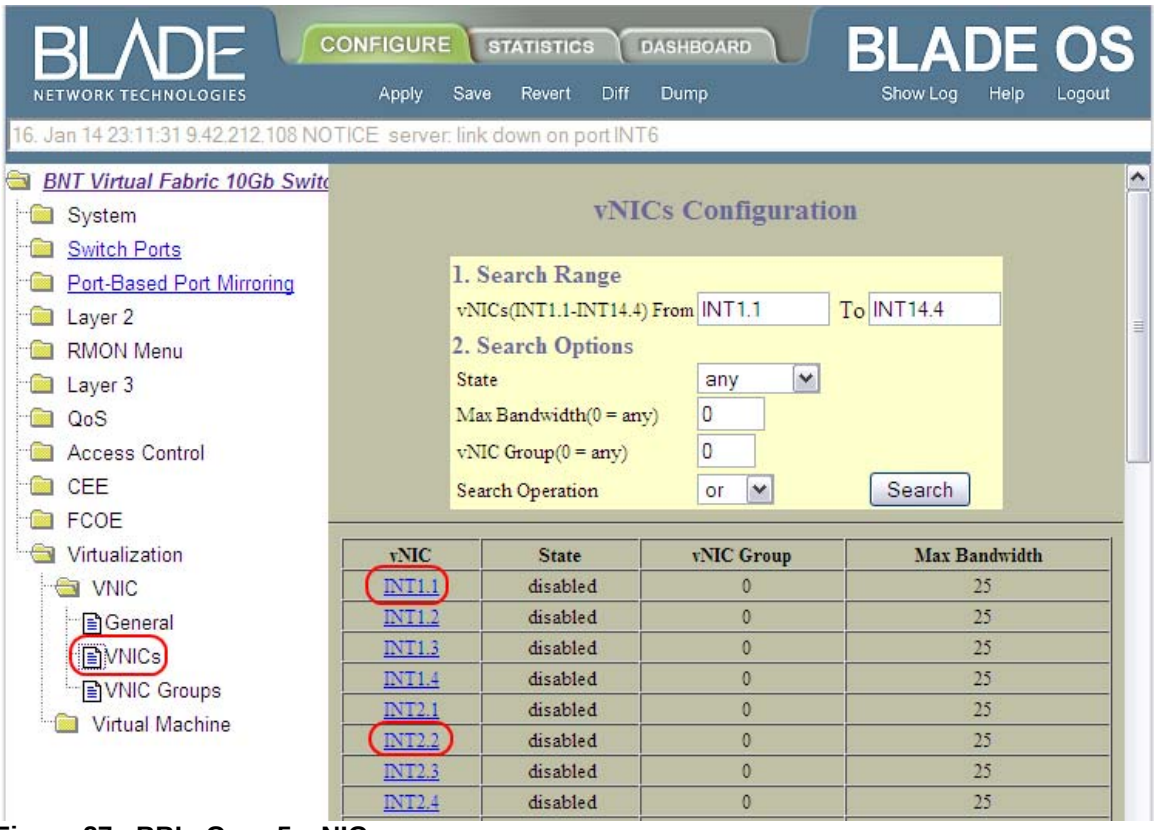


Figure 27 - BBI : Case 5, vNICs pane

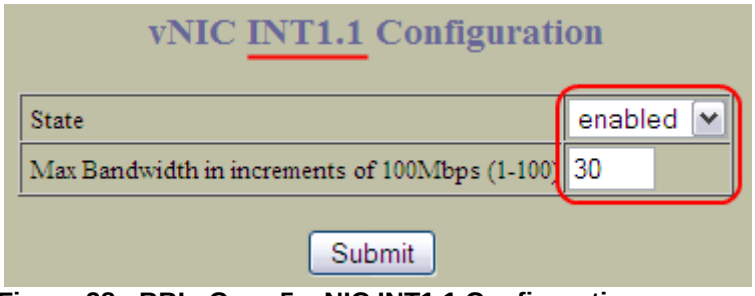


Figure 28 - BBI : Case 5, vNIC INT1.1 Configuration

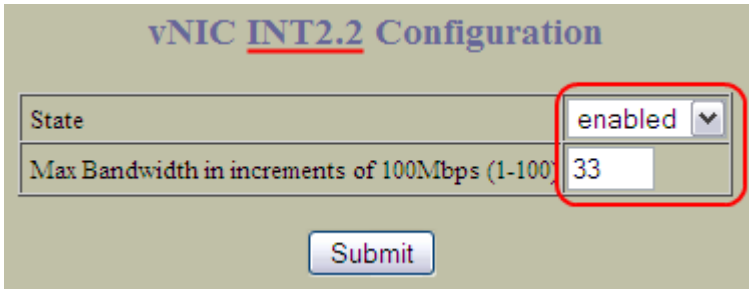


Figure 29 - BBI : Case 5, vNIC INT2.2 Configuration

3. Enable the trunk group.

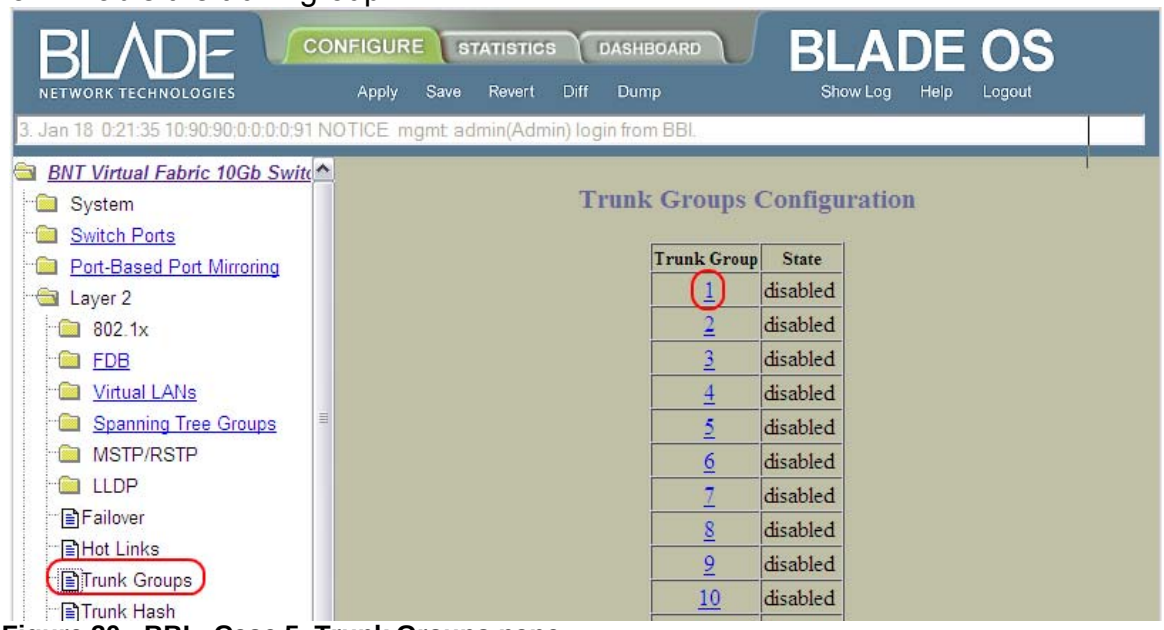


Figure 30 - BBI : Case 5, Trunk Groups pane

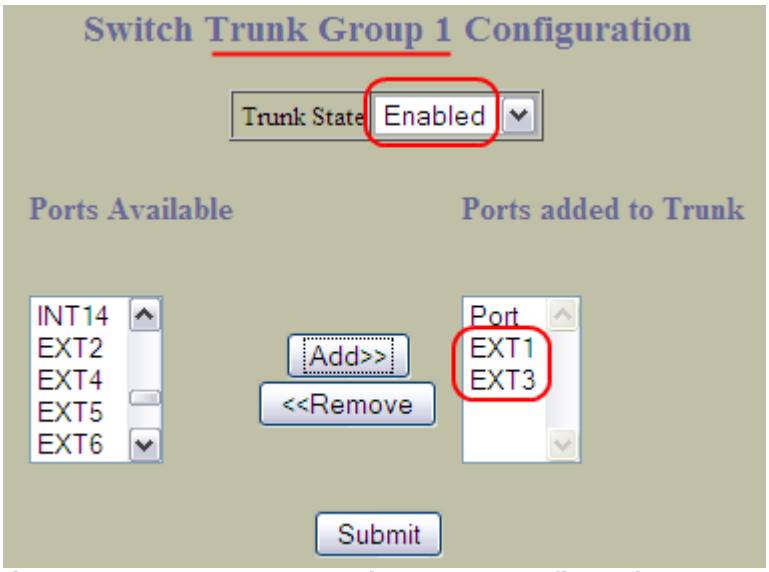


Figure 31 - BBI : Case 5, Trunk Group 1 Configuration

4. Enable and configure the vNIC group.

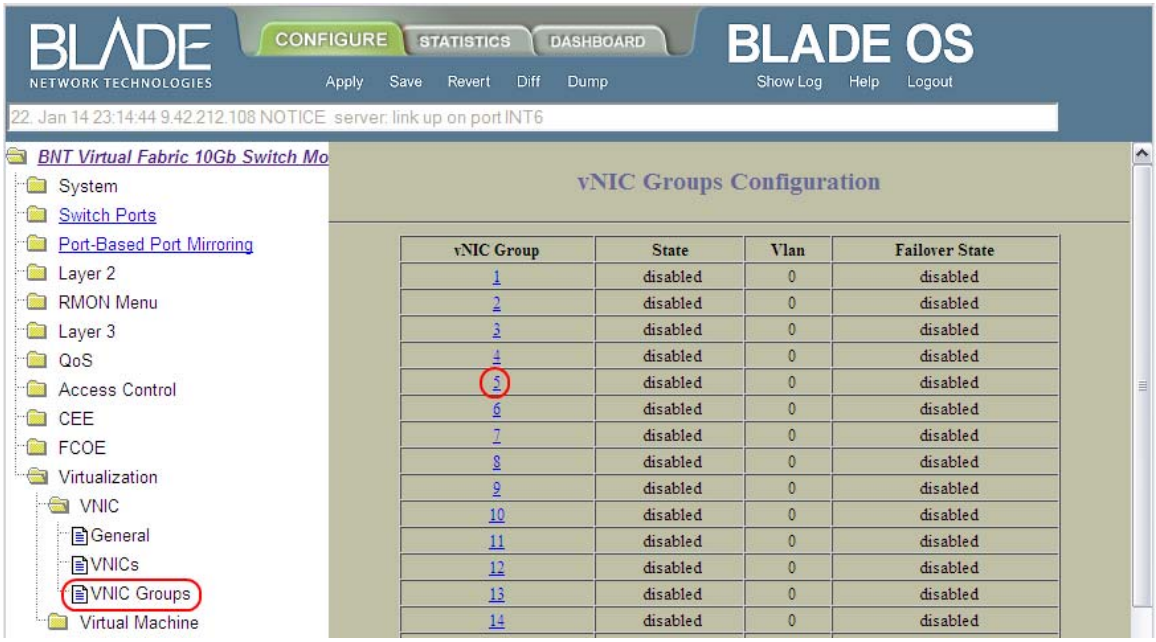


Figure 32 - BBI : Case 5, vNIC Groups pane

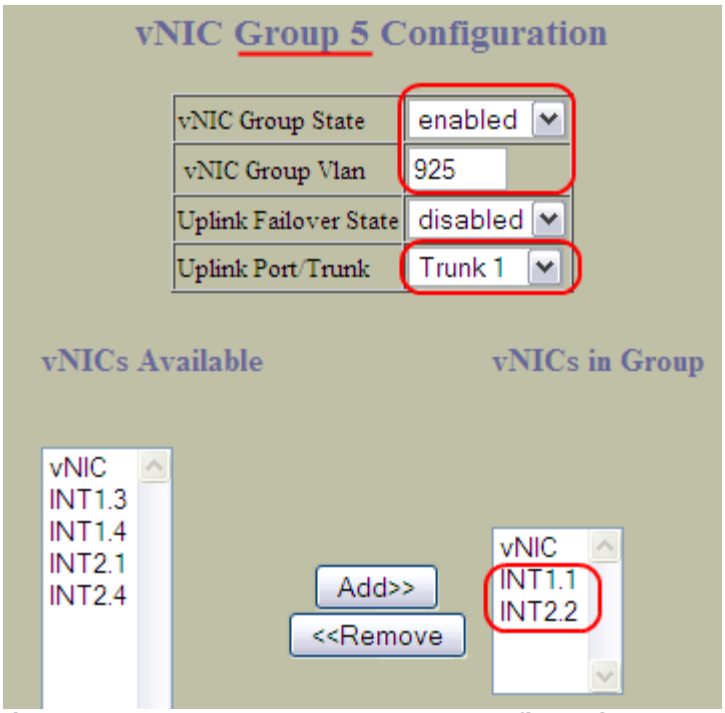


Figure 33 - BBI : Case 5, vNIC Group Configuration

Case 6 - vNICs and pNICs , One uplink trunk

Represented as VGRP 6 in Figure 1 on p.11, this group consists of vNIC and pNIC ports, and one uplink trunk.

Switch CLI

The following command script can be used to implement this configuration.

```
/c/l2/trunk 5
        ena
        add EXT3
        add EXT4
/c/virt/vnic
        on
/c/virt/vnic/port INT1/vnic 4
        ena
        bw 25
/c/virt/vnic/port INT2/vnic 4
        ena
        bw 10
/c/virt/vnic/vnicgrp 6
        ena
        vnicvlan 1010
        addvnic INT1.4
        addvnic INT2.4
        addport INT4
        addport INT5
        addtrnk 5
apply
```

Switch BBI

Click on the 'Configure' tab, then perform the following sequence of web interface entries to implement this configuration.

1. Enable vNIC operation. (Submit, Apply … and Save, if you want it to persist after switch reboot.)

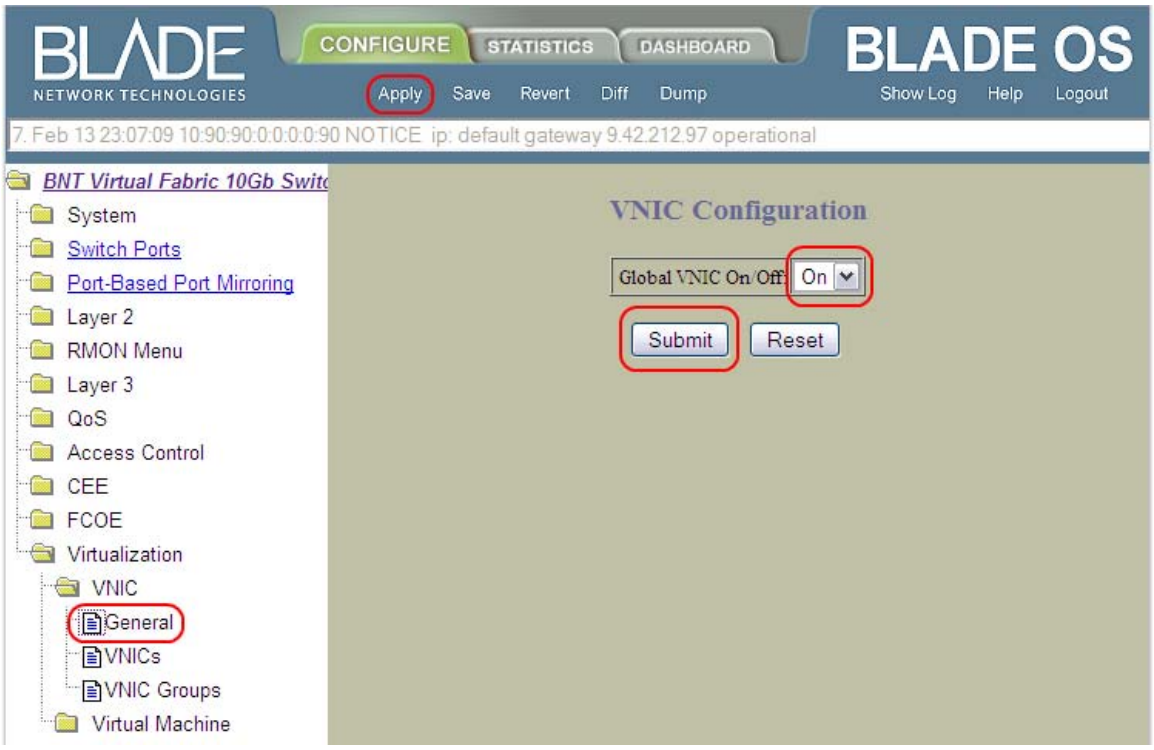


Figure 34 - BBI : Case 6, Enable vNIC operation

2. Enable and configure vNICs (remember to Submit and Apply).

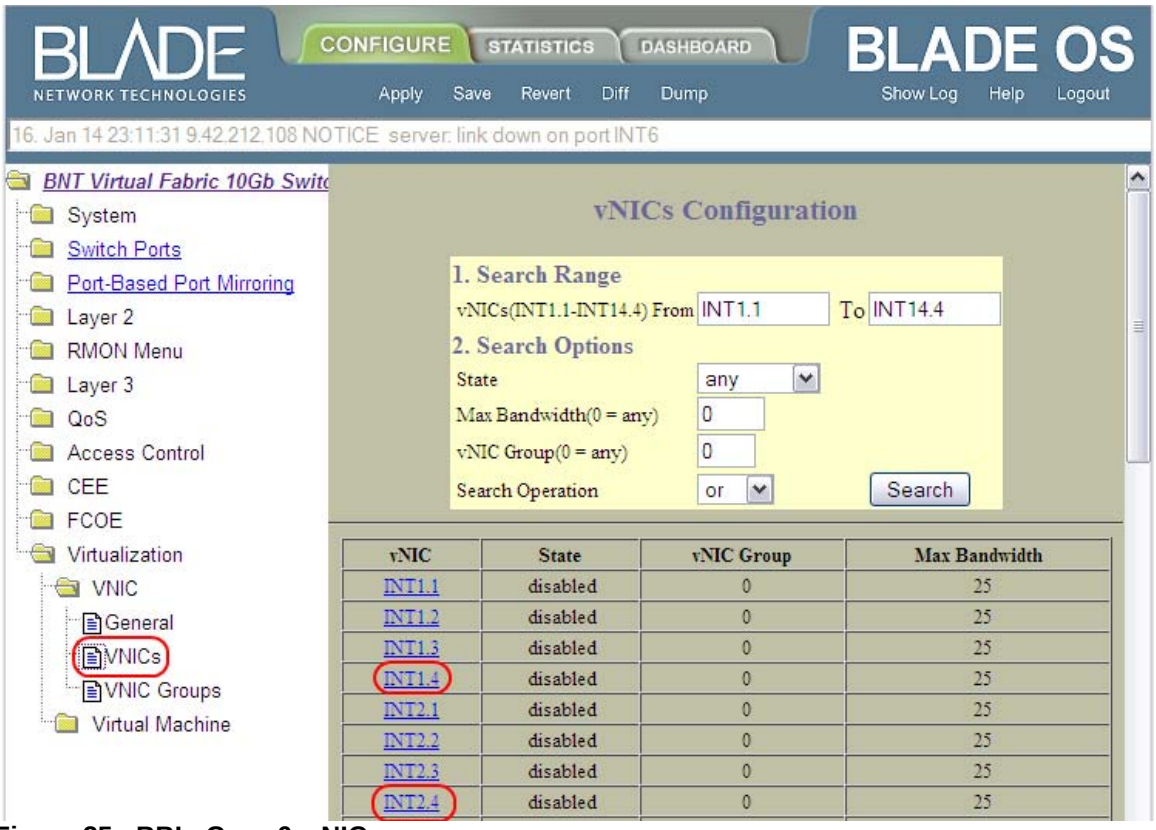


Figure 35 - BBI : Case 6, vNICs pane

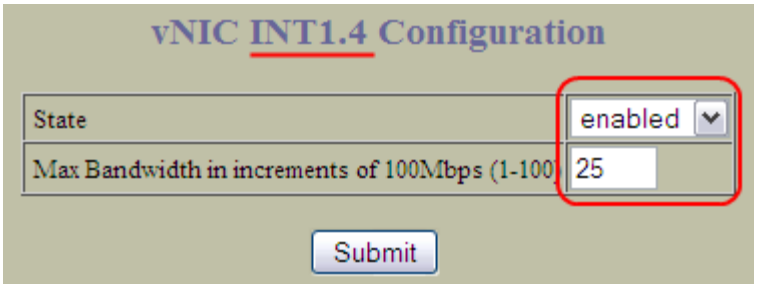


Figure 36 - BBI : Case 6, vNIC INT1.4 Configuration

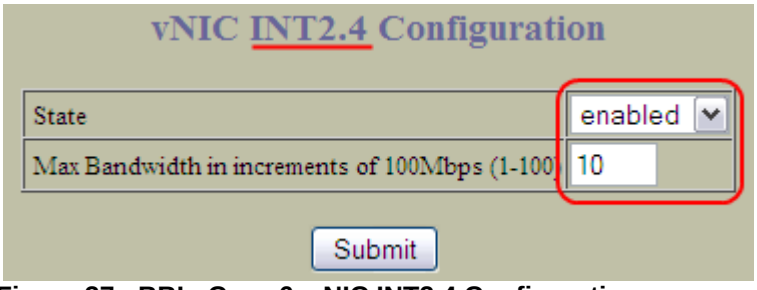


Figure 37 - BBI : Case 6, vNIC INT2.4 Configuration

3. Enable the trunk group.

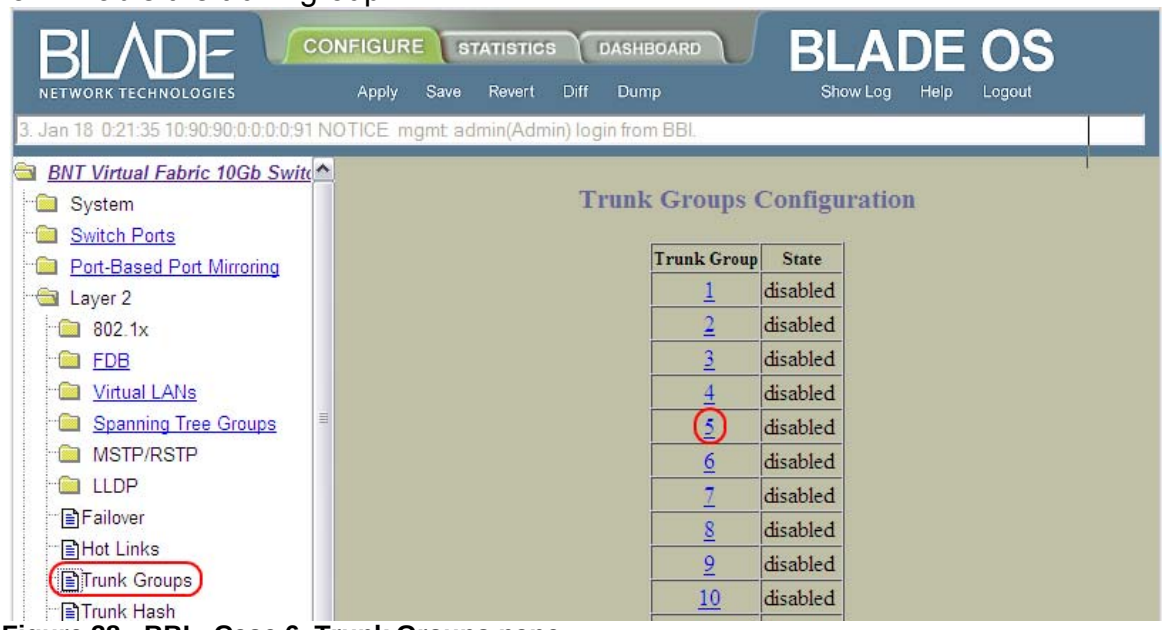


Figure 38 - BBI : Case 6, Trunk Groups pane

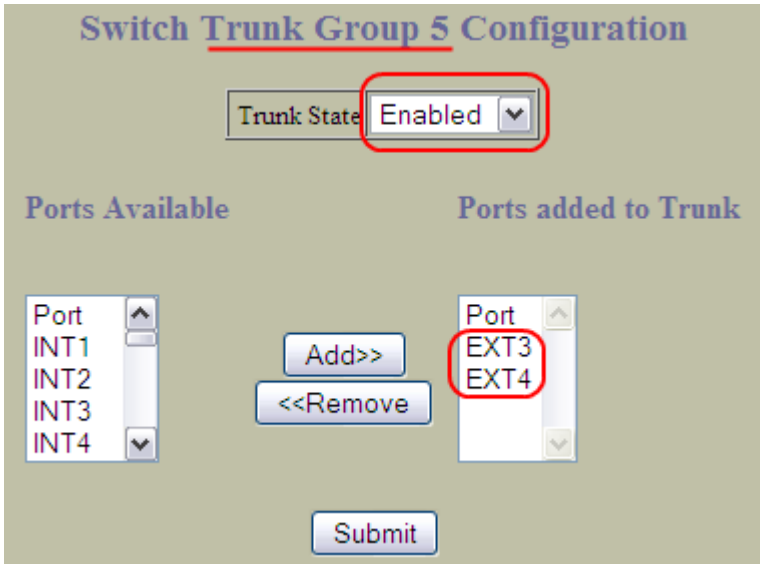


Figure 39 - BBI : Case 6, Trunk Group 5 Configuration

4. Enable and configure the vNIC group.

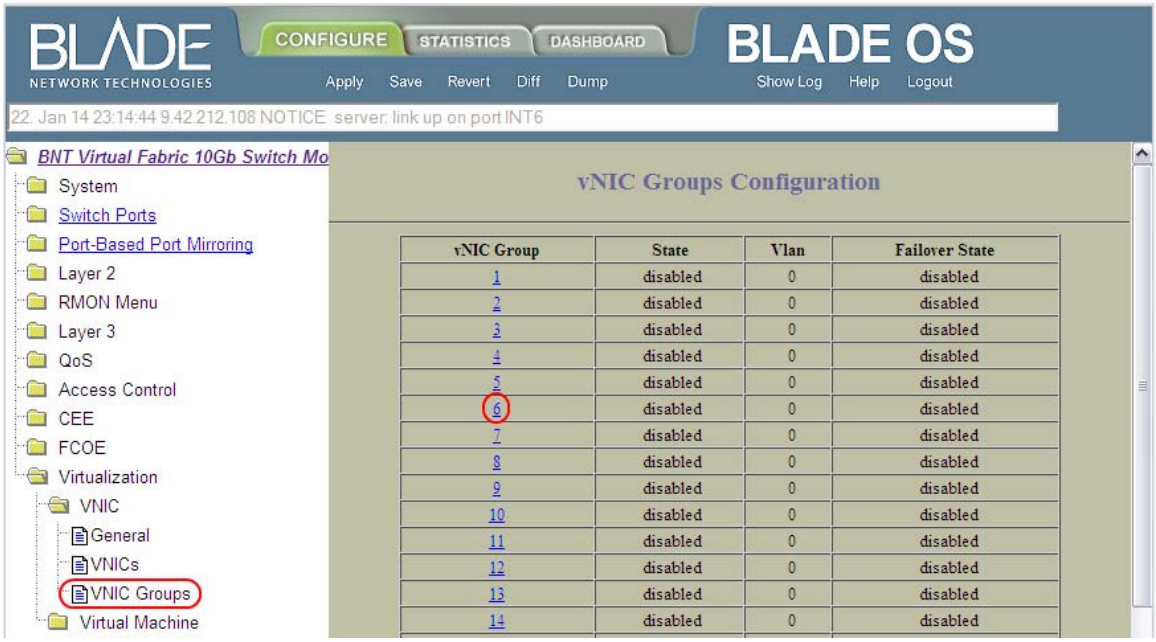


Figure 40 - BBI : Case 6, vNIC Groups pane

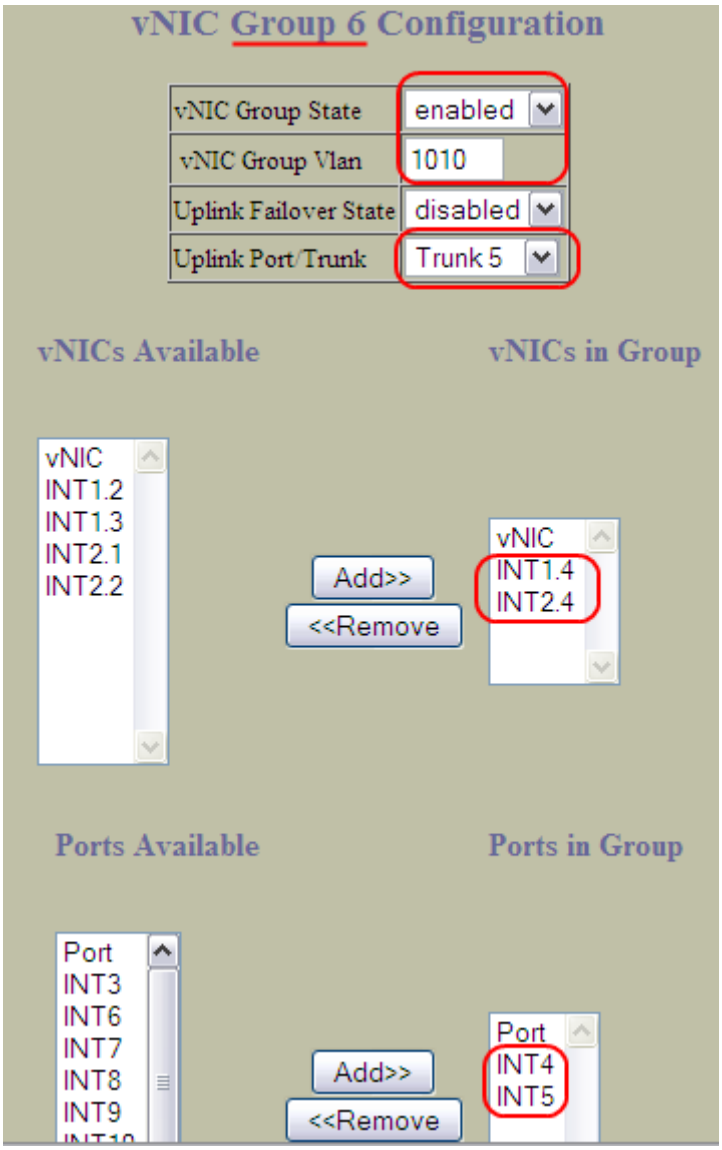


Figure 41 - BBI : Case 6, vNIC Group Configuration

Related Documentation

Virtual Fabric Switch (VFS) documentation is available at:

http://www.ibm.com/systems/support/supportsite.wss/brandmain?brandind=5000020

Enter “BNT Virtual Fabric” (including the quotes) in the search box in the upper right and click the `Search` button. Click on the ‘Publications’ item in the results list and select the document of interest.

1) *BNT Virtual Fabric 10Gb Switch Module for IBM BladeCenter, Application Guide*
2) *BNT Virtual Fabric 10Gb Switch Module for IBM BladeCenter, Command Reference*
3) *BNT Virtual Fabric 10Gb Switch Module for IBM BladeCenter, ISCLI Reference*
4) *BNT Virtual Fabric 10Gb Switch Module for IBM BladeCenter, Browser Based Interface Quick Guide*

Virtual Fabric Adapter (VFA) documentation is available at:

http://www.ibm.com/systems/support/supportsite.wss/brandmain?brandind=5000020

Enter “Emulex Virtual Fabric” (including the quotes) in the search box in the upper right and click the `Search` button. Click on the ‘Publications’ item in the results list and select the document of interest.

5) *Installation and User's Guide for Emulex Virtual Fabric Adapter (CFFh)*
6) *Emulex Virtual Fabric Adapter Release Notes*