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GbESM
L2-L7/L2-L3
Product Marketing

> **Comparison of Layer 2/Layer 3 Functionality offered in various Nortel Networks Gigabit Ethernet Switch Modules for IBM eServer BladeCenter**

White Paper

Blade Server Switching
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1   Introduction

This white paper explains the functional and configuration differences, regarding Layer 2-3 switching functionality, among the three options for Ethernet switching modules from Nortel Networks for the IBM eServer BladeCenter.

These three options for switching modules for the IBM eServer ® BladeCenter[TM] from Nortel Networks are:

- Nortel Networks® Layer 2-7 Gigabit Ethernet Switch Module (GbESM 2-7)
  The IBM option P/Ns for this option is 73P9057.

- Nortel Networks® Layer 2/3 Gigabit Ethernet Switch Module – Copper (GbESM 2/3)
  The IBM option P/Ns for this option is 26K6530.

- Nortel Networks® Layer 2/3 Gigabit Ethernet Switch Module – Fiber (GbESM 2/3)
  The IBM option P/Ns for this option is 26K6531.

While both GbESM L2-7 and GbESM L2/3 offer basic Layer 2-3 switching functionality, GbESM L2-7 has additional features based on Layer 4-7 information, such as Security and Load Balancing. Complete details of the features offered by GbESM L2-7 are available in [1] and those offered in GbESM L2/3 are described in [3].

The L2-3 switching functionality and other related features on GbESM L2-7 and GbESM L2/3 are very similar but do differ in some areas. The purpose of this document is to describe these differences. The target reader for this document is one who is familiar with basic Layer 2-3 features.

The document is divided into three sections:

1. Features that are available only on GbESM L2/3 firmware version 1.0.1.6
2. Features that are available in both GbESM L2-7 firmware version 20.2.2.6 and GbESM L2/3 version 1.0.1.6
3. Features that are available only on GbESM L2-7 firmware version 20.2.2.6

1.1 L2/3 Features Unique to the L2/3 GbESM

The features described in this section are not available on GbESM L2-7 as of release 20.2.2.6. The following links can be accessed for information regarding the latest firmware release:

Nortel Networks Layer 2-7 Gigabit Ethernet Switch Module –
http://www.ibm.com/pc/support/site.wss/document.do?lndocid=MIGR-53058

Nortel Networks Layer 2/3 Gigabit Ethernet Switch Module –
http://www.ibm.com/pc/support/site.wss/document.do?lndocid=MIGR-58216

1.1.1   802.1w (RSTP) and 802.1s (MSTP)

Rapid Spanning Tree Protocol enhances the IEEE 802.1d Spanning Tree Protocol to provide rapid convergence on Spanning Tree Group 1. Multiple Spanning Tree Protocol extends the IEEE 802.1w Rapid Spanning Tree Protocol, to provide both rapid convergence and load balancing in a VLAN environment.

IEEE 802.1s Multiple Spanning Tree extends the IEEE 802.1w Rapid Spanning Tree Protocol through multiple Spanning Tree Groups. MSTP maintains up to 16 spanning-tree instances that correspond to STP Groups 1-16.

1.1.2   802.1x Port Authentication (Extensible Authentication Protocol over LAN)

GbESM L2/3 can provide user-level security for its ports using the IEEE 802.1x protocol, which is a more secure alternative to other methods of port-based network access control. Any device attached to an 802.1x-enabled port that fails authentication is prevented access to the network and denied services offered through that port.

The 802.1x standard describes port-based network access control using Extensible Authentication Protocol over LAN (EAPoL). EAPoL provides a means of authenticating and authorizing devices attached to a LAN port that has point-to-point connection characteristics and of preventing access to that port in cases of authentication and authorization failures.

1.1.3   RIPv2

GbESM L2-7	GbESM L2/3
Routing information Protocol version 1 (RIPv1)	RIPv2 (including RIPv1compatibility mode)

RIPv2 is the most popular and preferred configuration for most networks. RIPv2 expands the amount of useful information carried in RIP messages and provides a measure of security. RIPv2 improves efficiency by using multicast UDP (address 224.0.0.9) data packets for regular routing updates. Subnet mask information is provided in the routing updates. A security option is added for authenticating routing updates, by using a shared password. GbESM L2/3 supports using clear password for RIPv2.

GbESM L2/3 allows you to configure RIPv2 in RIPv1compatibility mode, for using both RIPv2 and RIPv1 routers within a network. In this mode, the regular routing updates use broadcast UDP data packet to allow RIPv1 routers to receive those packets. With RIPv1 routers as recipients, the routing updates have to carry natural or host mask. Hence, it is not a recommended configuration for most network topologies.

RIP can be turned ON/OFF globally. When ON, each interface can either run RIPv1 or it can run RIPv2.

1.1.4   ECMP

With Equal Cost Multiple Path routes, a router potentially has several available next hops towards any given destination. ECMP allows separate routes to be calculated for each IP Type of Service. All paths of equal cost to

a given destination are calculated, and the next hops for all equal-cost paths are inserted into the routing table. GbESM L2/3 supports 682 ECMP routes.

1.1.5   Access Control Lists

Access Control Lists (ACLs) are filters that allow you to classify and segment traffic, so you can provide different levels of service to different traffic types. Each filter defines the conditions that must match for inclusion in the filter, and also the actions that are performed when a match is made.

The following command can be used to configure ACLs:

```
/cfg/acl
```

1.1.6   HTTPS

The BBI can be accessed via a secure HTTPS connection over management and data ports. To enable BBI Access on the switch via HTTPS, use the command `/cfg/sys/access/https/https`. To change the HTTPS Web server port number from the default port 443, use the command `/cfg/sys/access/https/port`. Accessing the BBI via HTTPS requires that you generate a certificate to be used during the key exchange. A default certificate is created the first time HTTPS is enabled, but you can create a new certificate defining the information you want to be used in the various fields. The certificate can be saved to flash for use if the switch is rebooted by using the `/apply` and `/save` commands. When a client (e.g. web browser) connects to the switch, they will be asked if they accept the certificate and can verify that the fields are what expected. Once BBI access is granted to the client, the BBI can be used as described in the *BBI Quick Guide*.

1.1.7   SNMPv3

SNMP version 3.0 is an enhanced version of the Simple Network Management Protocol, approved by the Internet Engineering Steering Group in March, 2002. SNMPv3 contains additional security and authentication features that provide data origin authentication, data integrity checks, timeliness indicators and encryption to protect against threats such as masquerade, modification of information, message stream modification and disclosure. SNMPv3 ensures that the client can use SNMPv3 to query the MIBs, mainly for security.

1.1.8   IGMP Filtering

With IGMP Filtering, you can allow or deny a port to send and receive multicast traffic to certain multicast groups. Unauthorized users are restricted from streaming multicast traffic across the network.

If access to a multicast group is denied, IGMP Membership Reports from the port are dropped; and the port is not allowed to receive IP multicast traffic from that group. If access to the multicast group is allowed, Membership Reports from the port are forwarded for normal processing.

1.1.9   802.1p Priority Queuing

The GbESM has eight output Class of Service (COS) queues per port, into which each packet is placed. Each packet's 802.1p priority determines its COS queue, except when an ACL action sets the COS queue of the packet. Each COS queue uses Weighted Round Robin (WRR) scheduling with user configurable weight, from 1 to 15. The weight of 0 (zero) indicates strict priority, which might starve the low priority queues. You can configure the following attributes for COS queues:

- Map 802.1p priority value to a COS queue
- Define the scheduling weight of each COS queue

Use the 802.1p menu (`/cfg/qos/8021p`) to configure COS queues.

1.1.10   QoS using DSCP

The six most significant bits in the TOS byte of the IP header are defined as DiffServ Code Points (DSCP). Packets are marked with a certain value depending on the type of treatment the packet must receive in the network device. DSCP is a measure of the Quality of Service (QoS) level of the packet.

The GbESM can perform the following actions to the DSCP:

- Read the DSCP value of ingress packets
- Re-mark the DSCP value to a new value
- Map the DSCP value to an 802.1p priority

Once the DSCP value is marked, the GbESM can use it to direct traffic prioritization. The GbESM can re-mark the DSCP value of ingress packets to a new value, and set the 802.1p priority value, based on the DSCP value.

1.1.11 L3 Trunking

L2/L3 hash parameters to be defined as a single unit (i.e. you cannot define L2 hash parameters separately from L3 hash parameters).

Trunk hash parameters are limited to only the following combinations:

- SMAC only
- DMAC only
- SIP only
- DIP only
- SIP + DIP
- SMAC + DMAC
- Default trunk hash parameters: SIP + DIP.

1.1.12 FTP Applications

All applications such as Configuration Backup/Restore, Upload FLASH dump, Upload Tech Support dump, etc. that supported TFTP services also support FTP services.

1.1.13 Scheduled Reboots

This feature allows the switch administrator to schedule a reboot to occur at a particular time in future. This feature is particularly helpful if the user needs to perform switch upgrades during off-peak hours. You can set the reboot time, cancel a previously scheduled reboot, and check the time of the currently set reboot schedule with the help of the Boot Schedule menu (`/boot/sched`).

1.1.14 NTP Requests

The command `/oper/ntpreq` allows the user to send requests to the NTP server.

1.1.15 Password change

The command `/oper/passwd` allows the user to change the password. You need to enter the current password in use for validation.

1.1.16 Configuration Change Tracking

The command `/oper/cfgtrk` displays a list of configuration changes made since the last apply command. Each time the apply command is sent, the previous configuration-tracking log is replaced with the latest changes.

1.1.17 Time Zone

The switch allows you to configure a time zone, in a manner similar to any Linux or Windows machine. It can be configured using the following command:

```
/cfg/sys/timezone
```

1.2 Implementation Differences for L2-3 Features Common to the GbESM L2/3 and GbESM L2-7

This section describes the differences in features that are available on both GbESM L2-7 and GbESM L2/3.

1.2.1   Forwarding Database Size

GbESM L2/3 supports 8192 entries in the MAC address table, whereas GbESM L2-7 supports 2048.

1.2.2   IGMP Snooping

Both GbESM L2-7 and GbESM L2/3 support IGMP Snooping. The differences in functionality are tabulated below:

Functionality	GbESM L2-7	GbESM L2/3
Join Suppression/Aggregation	No	Yes
IGMP Leave Proxy	No	Yes
Group Specific Query to Port (FastLeave disabled)	No	Yes
Mixed Version support (ignore Leave if Group is v1/v2 whereas Mrouter is v1)	No	Yes
IGMP Groups	256	64
Querier election	No	Yes
Restrict Single Mrouter port on VLAN	No	Yes

1.2.3   Management Network Configuration

To limit access to the switch without having to configure filters for each switch port, you can set a source IP address (or range) that will be allowed to connect to the switch IP interface through Telnet, SSH, SNMP, or the Browser-Based Interface (BBI). This will also help to prevent spoofing or attacks on the switch's TCP/IP stack.

When an IP packet reaches the switch, the source IP address is checked against the range of addresses defined by the management network and mask, (/mnet and /mmask). If the source IP address of the host is within this range, users are allowed to attempt to log in. Any packet addressed to a switch IP interface with a source IP address outside this range is discarded.

In GbESM L2-7, you can only specify a single network. In GbESM L2/3, this has been enhanced to allow user to specify up to five such networks using the Management Networks Menu (cfg/sys/access/mgmt).

1.2.4   Trunk Hash

This feature allows you to configure the particular parameters for the GbESM Trunk Hash algorithm instead of having to utilize the defaults.

This feature differs on GbESM L2-7 and GbESM L2/3 in the degree of freedom available for selecting the particular parameters, as tabulated below:

GbESM L2-7	GbESM L2/3
Layer 2 trunk hash parameters can be defined independently of the Layer 3 trunk hash parameters.	Layer 2/ Layer 3 hash parameters must to be defined as a single unit (i.e. you cannot define Layer 2 hash parameters separately from Layer 3 hash parameters).
You can configure new default behavior for Layer 2 traffic and Layer 3 traffic separately. You can select one of the following configurations: • Source IP (SIP) • Destination IP (DIP) • Source MAC (SMAC) • Destination MAC (DMAC) • Source IP (SIP) + Destination IP (DIP) • Source MAC (SMAC) + Destination MAC (DMAC) • Source MAC (SMAC) + Source IP (SIP) • Source MAC (SMAC) + Destination IP (DIP)	You configure new default behavior for Layer 2 traffic and Layer 3 traffic as one unit. You can select one of the following configurations: • Source IP (SIP) • Destination IP (DIP) • Source MAC (SMAC) • Destination MAC (DMAC) • Source IP (SIP) + Destination IP (DIP) • Source MAC (SMAC) + Destination MAC (DMAC)

1.2.5   Jumbo Frame Support

GbESM L2-7 allows selective support for jumbo frames (9000 bytes) on a per VLAN basis. GbESM L2/3 allows full support for jumbo frames on all VLANs.

1.2.6   ARP Configuration

GbESM L2-7	GbESM L2/3
Static (permanent) ARP entries can be configured using the Address Resolution Protocol Menu in the Maintenance Tree (`/maint/arp`)	Static (permanent) ARP entries can be configured using the Address Resolution Protocol Menu in the Configuration Tree (`/cfg/l3/arp/static`)
Fixed.	User can specify period for "Re-ARP."

1.3 L2/3 Features Unique to the L2-7 GbESM

The features described in this section are not available on GbESM L2/3 as of release 1.0.1.1. Please check for information about the latest firmware release.

1.3.1   Default Gateway Load Balancing

On GbESM L2-7, Default Gateways 1 through 4 are used for load-balancing session requests. There is no load-balancing functionality within this feature in GbESM L2/3.

1.3.2   IP forwarding Per Interface

IP forwarding can be enabled and disabled per interface on GbESM L2-7.In GbESM L2/3, IP forwarding is a global configuration parameter only.

1.3.3   Switch IP address via BOOTP

If available on your network, a BOOTP server can supply the switch with IP parameters so that you do not have to enter them manually.

2   Configuration Commands

The following commands reflect the changes outlined in the earlier sections.

Feature	GbESM L2-7	GbESM L2/3
Local Network	–	`/cfg/l3/frwd/local`
IGMP Snooping	`/cfg/l3/igmp/robust`	`/cfg/l3/igmp/snoop/robust`
	`/cfg/l3/igmp/qinterval`	`/cfg/l3/igmp/snoop/timeout`
	`/cfg/l3/igmp/qmrt`	`/cfg/l3/igmp/snoop/mrto`
	`/cfg/l3/igmp/on`	`/cfg/l3/igmp/snoop/ena`
	`/cfg/l3/igmp/off`	`/cfg/l3/igmp/snoop/dis`
	`/cfg/l3/igmp/cur`	`/cfg/l3/igmp/snoop/cur`

	`/cfg/l3/igmp/snoop/add`
	`/cfg/l3/igmp/snoop/rem`
	`/cfg/l3/igmp/snoop/clear`
		–

	`/maint/igmp/snoop`	`/maint/igmp`
	`/maint/igmp/mrouter`	–

Management Network	`/cfg/sys/access/mnet`
	`/cfg/sys/access/mmask`
		`/cfg/sys/access/mgmt/add`
		`/cfg/sys/access/mgmt/rem`
		`/cfg/sys/access/mgmt/cur`

Trunk Hash	`/cfg/l2/thash/l2`	`/cfg/l2/thash/set`
	`/cfg/l2/thash/l3`	–
Jumbo Frame Support	`/cfg/l2/vlan/jumbo`	–
ARP	`/maint/arp/add`	`/cfg/l3/arp/static/add`
	`/maint/arp/del`	`/cfg/l3/arp/static/del`
	`/main/arp/find/rfpt`	–
	–	`/cfg/l3/arp/rearp`
Default Gateway	`/cfg/l3/metrc`	–
RIP	`/cfg/l3/rip1/updat`	`/cfg/l3/rip/update`
	`/cfg/l3/rip1/spply`	`/cfg/l3/rip/if/supply`
	`/cfg/l3/rip1/deflt`	`/cfg/l3/rip/if/default`
	`/cfg/l3/rip1/statc`	–
	`/cfg/l3/rip1/vip`	–
	`/cfg/l3/rip1/poisn`	`/cfg/l3/rip/if/poison`
	`/cfg/l3/rip1/on`	`/cfg/l3/rip/on`

Feature	GbESM L2-7	GbESM L2/3
	`/cfg/l3/rip1/off`	`/cfg/l3/rip/off`
	`/cfg/l3/rip1/cur`	`/cfg/l3/rip/current`
	–	`/cfg/l3/rip/if/version`
	–	`/cfg/l3/rip/if/listen`
	–	`/cfg/l3/rip/if/poison`
	–	`/cfg/l3/rip/if/trigg`
	–	`/cfg/l3/rip/if/mcast`
	–	`/cfg/l3/rip/if/metric`
	–	`/cfg/l3/rip/if/auth`
	–	`/cfg/l3/rip/if/key`
	–	`/cfg/l3/rip/if/enable`
	–	`/cfg/l3/rip/if/disable`
	–	`/cfg/l3/rip/if/current`
BOOTP	`/cfg/sys/bootp`	–
Miscellaneous	`/maint/image/lsdmp`	–

3 References

1. Nortel Networks Layer 2-7 GbE Switch Module Application Guide
    Part number 25K9199
    http://www.ibm.com/pc/support/site.wss/document.do?lndocid=MIGR-53098

2. Nortel Networks Layer 2-7 GbE Switch Module Command Reference
    Part number 25K9198
    http://www.ibm.com/pc/support/site.wss/document.do?lndocid=MIGR-53101

3. Nortel Networks Layer 2-3 GbE Switch Module Application Guide
    Part number 59P4392
    http://www.ibm.com/support/docview.wss?rs=113&uid=psg1MIGR-58325

4. Nortel Networks Layer 2-3 GbE Switch Module Command Reference
    Part number 59P4353
    http://www.ibm.com/support/docview.wss?rs=113&uid=psg1MIGR-58326