IBM appreciates the opportunity to provide comments to the ENERGY STAR® Large Network Equipment (LNE) Framework Document and the ENERGY STAR LNE Draft 1 Test Method. IBM manufactures and markets data center access and aggregation switches and, therefore, has an interest in ensuring that the final LNE energy efficiency and testing requirements are both technically and economically feasible while furthering the mission of ENERGY STAR to recognize and promote the sale of energy efficient products.

IBM offers the following comments on the Framework Document and the Draft 1 Test Method.

FRAMEWORK DOCUMENT

A. Definitions (c), Small Network Equipment (SNE): IBM requests that the SNE definition state that SNE contains 11 or less wired Physical Network Ports, not greater than 11 wired, physical network ports.

B. Definitions (c), Security Appliance: IBM supports EPA's position that it should exclude Security Appliances from Version 1 of the ENERGY STAR LNE requirements. This recommendation is based on the following analysis:

1. Security appliances come in two primary configurations: in-line appliances, which are 'bump-in-the-wire' topology that inspect and/or analyze (and in certain cases, block) network traffic as it moves through critical network junctures; and appliances that 'tap' the network traffic, which sample (but do not impede or interdict) data traffic. As such, each type of security appliance has different metrics, both of which are different than the metrics that would be used for network switches and routers. In the case of in-line deep packet inspection security appliances, the throughput is dependent on the level of inspection (certain customers prefer to block or restrict throughput to ensure 100% security inspection; others prefer 100% network uptime over security). As such, security appliances do not fit well within the performance/power metrics for LNE.
2. By the nature of their task, security appliances have a limited opportunity for power management or dynamically adjusting power to match utilization. The systems must be able to respond quickly to changes in network traffic, limiting the latency that can be tolerated from power management capabilities.
3. Approximately 1% of IBM's currently available security systems have more than 11 ports, meaning that most would be exempt from the LNE requirements.
4. Security appliances represent a very small portion of the LNE market. Based on IDC data, security appliances' revenue of \$532 M[1] represents approximately 0.4 percent of the 2011 service provider network market revenue of \$135 B[2]. In terms of number of products introduced into the market, security appliances are a

[1] http://idc-cema.com/eng/about-idc/press-center/49334-security-appliance-market-shows-healthy-growth-across-cema-region-idc-study-reveals
[2] http://itcandor.net/2012/04/25/networks-q212%EF%BB%BF%EF%BB%BF/

miniscule percentage of the marketplace. IBM security appliance sales are a similar percentage of its network equipment sales.

5. While network systems encompass tens to thousands of network devices from the access layer to the core layer, security appliances are only located at critical systems junctions. This is the technical reason that security appliance volumes are a very small percentage of network system volumes.

The bulk of the opportunity for reducing energy use in Ethernet networks resides in the routers and switchers used in the Data Center or the Enterprise. The different nature of and metrics associated with security appliances offers no synergies or benefits for evaluating security appliances under the LNE requirements. IBM recommends that EPA exclude network appliances from the LNE requirements.

C. Definitions (c), Product Types: IBM recommends that the listed product types be distinguished and excluded from LNE Version 1 Requirements.

1. Storage Area Networks: The Product Types do not specifically distinguish storage area networks that are based on fibre channel technology. Storage Area Networks are largely confined to the data center supporting communications between servers and storage systems and operating on fibre channel technology. The fibre channel switches have different metrics than Ethernet switches and would not fit easily into categorization of Ethernet switches. There are two types of switches that exist in this space, both of which IBM proposes be excluded from the Large Network Equipment category.

    a. Fibre channel switches: These switches manage communications between servers and storage systems inside the data center space.
    b. Converged switches: These switches integrate fibre channel and internet connectivity to create a more versatile switch for managing data center connectivity between systems and to the network. The converged switches are also a relatively small part of the market.

    IBM recommends that these switches be considered as a separate category for a future ENERGY STAR requirements document.

2. Embedded Blade and Server switches: The I/O connectivity for blade or server systems are provided by modular systems which are “embedded” in the server or blade chassis hardware. These systems are typically “modular” in nature (*i.e.* you can install one to some defined number of switches in a given blade chassis or server depending on the workload and requirements of the applications being run on the server). These switches can connect to an access switch or they can serve as a server level access switch which connects to a data center aggregation layer router. Given the diversity of embedded switches across the range of server products, IBM recommends that EPA not include embedded blade or server switches in this product category, as they are implicitly managed with the requirements of the server requirements.

D. Definitions (c), Product Characteristics: IBM recommends that EPA consider using terms other than not use the designation of "Managed" and "Unmanaged" to differentiate categories of for network equipment. All network systems are managed in some way. Many routers contain an embedded CPU processor and additional, supporting circuitry. The differentiator between different routers and switches, in terms of power use, is the presence of a processor to manage the switch or router. Currently, management processors are primarily found in modular switches; their presence is expected to increase in fixed switches as technologies move forward. We propose that the differentiation be made between switches and routers which have CPU based management and those with network based management and the use of a different terminology to describe the two management approaches.

In addition, we do not think that the presence of redundant power supplies has any bearing on the categorization of systems. Similar to most servers, it is an operational choice which is offered across a range of products of differing complexity.

E. Definitions (c), Operational States and Modes: In general, network routers and switches do not have an "off" switch. By its nature, a switch or router is intended to manage network traffic. The equipment is installed with the expectation that it will be either fully operational, managing network traffic, or in an idle state where traffic is not present. In general, the device needs to be in a ready mode to manage and route "new" traffic.

The definitions of Idle and Active states should be clarified. In the active mode, the equipment has all its functionality available and active transmission of user data is occurring. Idle means active processing of user data is not occurring, but the port is ready to manage data in accordance with equipment latency times. An idle condition assumes that the ports are connected but the data is not flowing due to variations in workload. The low power mode will be integrated to the idle mode, as it typically is with other Enterprise ICT equipment. After a certain number of inactive cycles, the system will transition to a lower power mode that maintains a specified latency or responds under a specific, standardized "wake-up" call. The low power mode will be optional for the equipment user and may or may not be activated based on the specific operational and performance constraints in the network system.

F. Eligible Product Categories: IBM recommends that EPA work with industry representatives and groups to carefully consider product categorization under the router and switch product categories. As IBM noted in the first round of LNE comments, there are Enterprise and Data Center class switches and routers which can be further segmented into access, aggregation, and core layers. At a minimum, IBM encourages EPA to aggregate switches and routers into these six groups and determine what, if any, further categorization is appropriate to segment the six categories. Once the categorization is determined, the number of product types, percent of total market and percent of total energy use should be assessed for the specified categories to determine which product

categories offer the best return for the effort expended. In addition, it should be determined whether a single test method and metric is appropriate for all categories or if specific categories need specific test methods.

IBM agrees that there may be sufficient TEER data or that sufficient TEER data can be generated for specific categories of fixed routers or switches to enable specifying qualification metrics. However, the data gathering effort discussed below will be important to assessing which product categories have sufficient data for creating qualification limits. Where data is insufficient, EPA should use Version 1 to collect TEER or other metric data.

G. Eligible Product Categories: IBM recommends that EPA perform a call for information on current market conditions for several of the requirements EPA is considering for V1 of the LNE requirements:

1. Power supply efficiencies for products currently on the market.
2. Available energy efficiency features/capabilities.
3. The availability of power use and inlet temperature data that can be transferred from the product to the network.
4. Availability of remote port administration.
5. Highest ASHRAE level for which the product is warrantied.
6. Availability of TEER performance data for the product.

This information is critical for informing EPA on current market conditions and the presence or absence of data to characterize current product characteristics against the proposed requirements.

H. Energy Efficiency Criteria and Test Procedures, system performance metrics: LNE equipment typically measure performance by tracking the number of packages dropped at a given line rate, routes supported, etc. The data transfer performance is established by the data rate of the given switch or router and the way you set-up the upload/download links and the capacity of the individual ports. The key indicator of a problem is when packets are not being transferred; there are not indicators of throughput or utilization that are typically reported up through the network.

I. Information and Management Requirements, Questions for Discussion:

Q2: What are typical performance data measurement, reporting, and output capabilities of LNE devices? What industry trends address reporting capabilities?

LNE products assess power use and system temperature; they are not necessarily reported into the network. Software development would be necessary to make the data available as required under the ENERGY STAR server and storage requirements. The performance data measurements as reported have to do with latency, packet throughput, and all the software L2/L3 features.

Q3: What information should be displayed in the product finder tool on the ENERGY STAR web site?

The specific data that should be reported on the product finder tool needs to be determined as part of the requirements development process. We do not have specific suggestions at this time.

Q4: Do LNE products have the ability to measure and self-report operations characteristics in an open, accessible format when interfacing with a third-party management software?

Yes, as discussed in question 2, data is collected through the Management Information Base (MIB) and Simple Network Management Protocol (SNMP). Software modifications or APIs would need to be written to make the data available to the network.

DRAFT 1 TEST METHOD:

A. Page 2 to 3: Power conditioning requirements should be matched to the requirements in the computer server and storage requirements, as the testing will often be done in the same lab and companies should not be required to buy separate equipment.

B. Page 6: Most manufacturers ship a router or switch with a base configuration and configurations will be established which maximize the efficiency of a given switch or router and which can serve as the "as shipped" configuration. That being said, no customer uses a box as configured. Customer will create a standard format for their switch and load that when they receive the system.

C. Page 7: IBM supports the proposal to test network equipment with half of the ports connected and with Energy Efficient Ethernet (EEE) enabled on switches where EEE is available.