White Paper

Dell® and Broadcom® Bring Energy Efficient Ethernet™ for 10GBASE-T and 1000BASE-T Ethernet Solutions to Dell PowerEdge® 12G Rack and Tower Servers

Ethernet is the most ubiquitous networking technology in the data center. Eighty eight percent of the ports within a data center are Ethernet ports[1]. Ethernet technology allows IT infrastructure to provide critical connectivity for communications between servers, clients, and storage resources. Dell® and Broadcom are leaders in Ethernet technology, providing high performance, energy-efficient server network connectivity solutions for the data center. Dell and Broadcom have leveraged their leadership positions to improve not only the performance of their Ethernet solutions, but also their energy efficiency. Historically, Broadcom has helped to reduce power consumption through greater component integration. Broadcom and Dell have also supported and helped to drive industry initiatives designed to further reduce power consumption. One such initiative is IEEE 802.3az, commonly referred to as Energy Efficient Ethernet™ (EEE).

1. Source: IT Brand Pulse (http://www.broadcom.com/collateral/wp/3G_C-NIC-WP100-R.pdf , Page 8).

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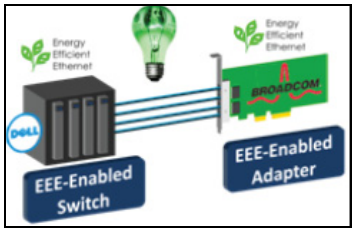
What is EEE?

EEE is designed to help IT administrators reduce the energy consumption of Ethernet- attached devices within their networks. Examples of such devices are Ethernet adapters and Ethernet switches. A key feature of the EEE standard is called Low Power Idle (LPI). As the name implies, when the Ethernet device is in an idle state (no data transmission activity), non-essential components of the Ethernet interface are placed in a low power state (sleep mode). A wake-up signal sent by the link partner allows the sleeping Ethernet device time to prepare for the receipt of incoming Ethernet data frames. EEE makes network energy conservation seamless and easy.

Why EEE?

Minimizing energy consumption is an ongoing challenge, and pressure is constantly on IT managers to do more with less resources. Studies have shown that approximately 50% of the electricity consumed is wasted by "powered on" equipment[a]. Ethernet devices are an example of such equipment. The increasing availability of digital content and our ever-growing reliance on such content are both driving up the demand for network bandwidth. This demand is causing the deployment of more Ethernet server ports and more Ethernet switch ports, which in turn translates into greater energy consumption. In most cases, network links are not utilized 100% of the time, and while in an idle state, they consume a substantial amount of energy. This only represents half of the potential power savings. While a server's Ethernet port is in idle mode consuming energy, there is a corresponding idle switch port that is also consuming energy. Given the number of ports in a typical data center, the energy consumed by idle ports can add up quickly.



a. ITU World Summit for an Information Society - EPFL - Working Group on the impact of ICT on the Environment: http://www.itu.int/dms_pub/itu-s/md/03/wsispc2/c/S03-WSISPC2-C-0043!!PDF-E.pdf

Why Dell EEE-Enabled GbE Adapters?

With Broadcom controller-based EEE-enabled adapters, power consumption during idle state is reduced by up to 42%. Table 1 below quantifies the power savings potential for Dell networking solutions using Broadcom EEE-enabled Ethernet controllers.

Table 1: Power Consumption and Savings

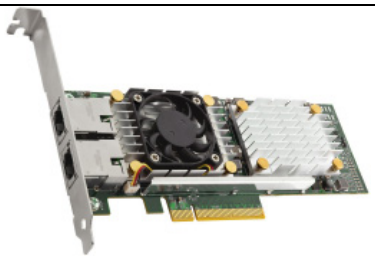
Broadcom 5720 and 5719 Based 1GbE Adapters	***2 Ports[a]***	***4 Ports[a]***
NIC port idle without EEE (W)	2.06	4.12
NIC port idle with EEE (W)	1.21	2.41
NIC port power savings with EEE (W)	0.85	1.71
NIC port with EEE Savings[b] (%)	42%	42%
Broadcom 57810S Based 10GbE Adapters	***2 Ports[a]***	
NIC ports idle without EEE (W)	12.8	
NIC ports idle with EEE (W)	9.4	
NIC ports power savings with EEE (W)	3.4	
NIC port power savings with EEE	27%	

a. When used in conjunction with an EEE-enabled switch.
b. Includes PHY, processor, and other components on the adapter.

As noted earlier, this only represents a portion of the energy savings. There is also a comparable energy savings to be realized when the corresponding EEE-enabled switch port is in an idle mode. Broadcom-based EEE-enabled network adapters combined with EEE-enabled network switches double your power savings, making it a win-win combination.

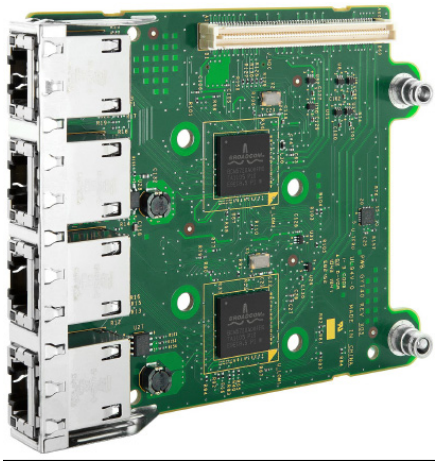
Dell Ethernet adapters utilizing the Broadcom controllers include:

Broadcom 5720 Dual-Port 1GbE Network Interface Card	• 1 GbE/2 Ports • L2 Networking • Dell P/N: 430-4423 (FH) or 430-4424 (LP)
Broadcom 5719 Quad-Port 1GbE Network Interface Card	• 1 GbE / 4 Ports • L2 Networking • Dell P/N: 430-4425 (FH) or 430-4426 (LP)
Broadcom 57810S Dual-Port 10GBASE-T Converged Network Adapter	• 10 GbE / 2 Ports • L2 Networking, iSCSI HBA, FCoE-ready • Dell P/N: 430-4419 (FH) or 430-4420 (LP
Broadcom 5720 Quad-Port 1GbE Rack Network Daughter Card	• 1 GbE / 4 Ports • L2 Networking • Dell P/N: 430-4418
Broadcom 57800S Quad-Port BASE-T Rack Converged Network Daughter Card	• Two 10GBASE-T & two 1000BASE-T Ports • L2 Networking, iSCSI HBA, FCoE-ready • Dell P/N: 430-4427

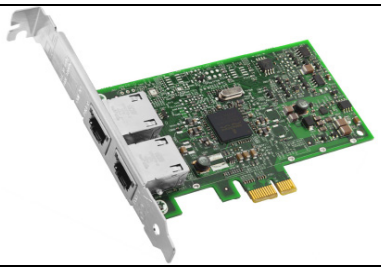


10GBASE-T Converged Network Adapter

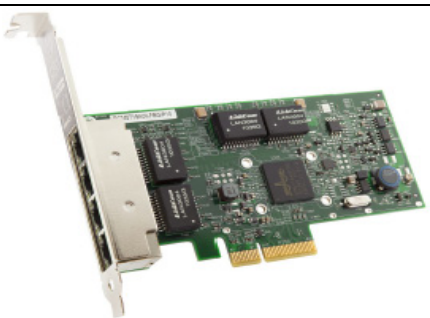
10GBASE-T Rack Network Daughter Card



Quad-Port 1GbE Rack Network Daughter Card



Dual-Port 1GbE NIC



Quad-Port 1GbE NIC

Conclusion

Technology innovation cycles, increase in volume of data traffic, and changes to computing models are driving the demand for greater bandwidth. This demand has resulted in an increase in energy consumption.

The Energy Efficient Ethernet (IEEE 802.3az) standard defines the mechanisms and protocols that transition Ethernet links into a low-power state during periods of low link utilization and help reduce energy consumption. When IEEE 802.3az compliant products have been fully deployed in new and existing Ethernet networks, it is estimated that the power savings in the United States alone can reach 5 terawatt hours per year, or enough energy to power 6 million 100 watt light bulbs. This translates into a reduction of the Information and Communication Technologies (ICT) carbon footprint by roughly 5 million tons per year[2].

By configuring Dell servers with EEE-enabled Broadcom adapters, IT administrators can reduce network adapter related energy costs by up to 42% when in an idle state. Furthermore, Broadcom's EEE-enabled adapters do not require complex configuration. Simply install the adapter and you are ready to go! Coupled with the energy savings realized with EEE-enabled switches, IT managers can make significant contributions in reducing operating expenses as well as their carbon footprint.

For more information, please visit: http://go.broadcom.com//dell12g

2. IEEE Standards Association: http://www.standardsinsight.com/ieee_news/ieee-802-3az-wins-best-electronic-design-award (Page 3).

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