Reducing Data Center Power Consumption with DMA Coalescing

Intel® Ethernet Server Adapters are the *only networking hardware in the industry* to offer Direct Memory Access (DMA) Coalescing, which can reduce platform power by as much as 8 to 12 watts.

Data center operators must strive to reduce utility costs as a component of operating expense to remain competitive. This requirement has led to the demand for higher energy efficiency in computer platforms, but data centers also need peak performance to meet growing business needs.

The optimal balance between energy efficiency and performance is typically obtained by operating at maximum performance for short durations when needed and then returning to low power states. Direct memory access (DMA) is one approach to taking advantage of that principle by adding intelligence to the way processor, chipset, and memory power states respond to DMA interrupts.

System components shift into low power states to reduce energy consumption when network traffic levels and other workload characteristics allow. The arrival of network data causes the DMA controller to issue an interrupt command that wakes the processor, chipset, and memory into higher power states.

Intel® Ethernet Server Adapters uniquely offer DMA Coalescing, an innovative capability that batches together DMA interrupts to be sent to the system for efficient processing. This capability optimizes the utilization of system resources and allows them to return to a lower power state more quickly than would otherwise be possible. Key aspects of DMA Coalescing are shown in Figure 1.
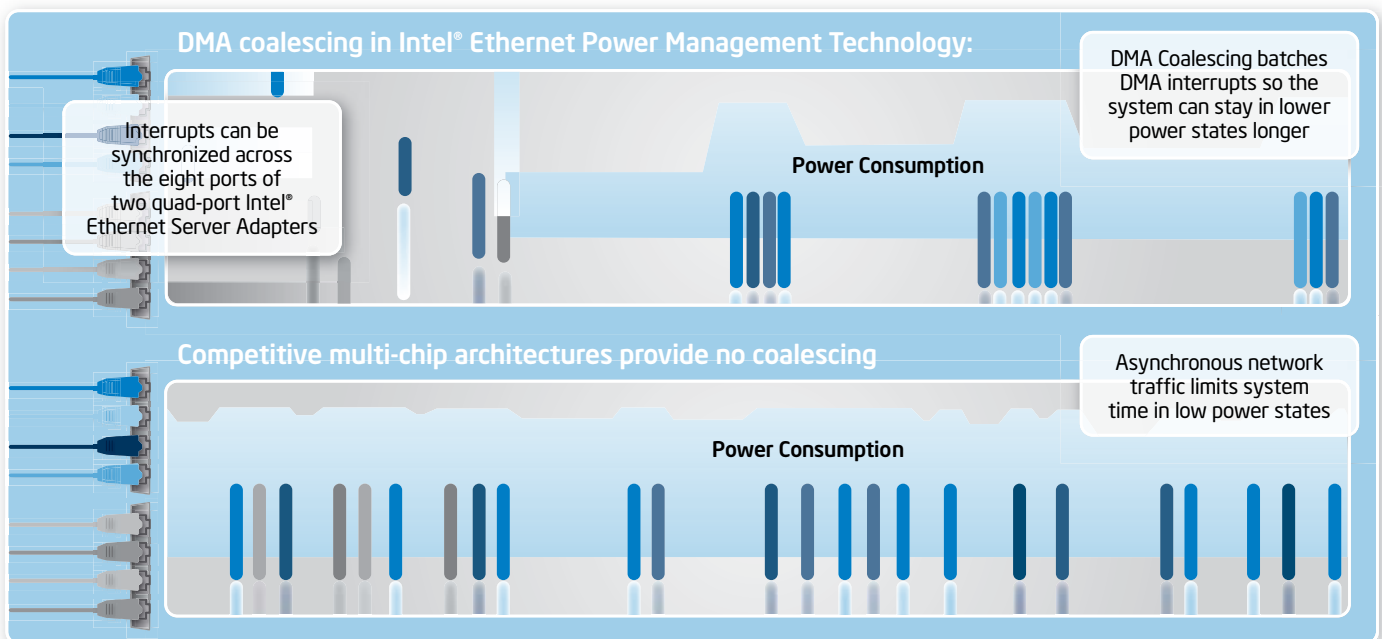

Figure 1. Intel® Ethernet Server Adapters are the only network hardware in the industry to offer DMA Coalescing, which lowers overall power consumption.

Complementary Aspects of Intel® Ethernet Power Management Technology

DMA Coalescing is one aspect of a larger set of capabilities known collectively as Intel Ethernet Power Management Technology. These capabilities work together to create more energy-efficient networking for the enterprise. As shown in Figure 2, different features of Intel Ethernet Power Management Technology contribute more to power consumption reduction at specific network-utilization levels.

Network Utilization 5 Percent and Lower: Energy Efficient Ethernet

Intel Ethernet support for Energy Efficient Ethernet (IEEE 802.3az) is most effective at low network traffic levels, taking advantage of low utilization to keep the link in a low power state as much as possible. This silicon-resident feature enables the Intel Ethernet Server Adapter to negotiate with the network switch ports connected to it. Adapter and switch ports enter and exit low power states together, saving dramatically on energy efficiency. DMA Coalescing shows no significant benefit at such low utilizations because not much data is transferred at such low data rates.

Network Utilization 5 to 25 Percent: DMA Coalescing

DMA Coalescing is most effective in the 5 to 25 percent range of network utilization, with maximum benefit at 25 percent. Industry studies report that most networks experience utilization rates below 25 percent. Therefore, DMA Coalescing is broadly advantageous at typical network utilization levels. This capability, including synchronization of DMA calls across the eight ports of two Intel® Ethernet I350 quad-port adapters, is unique to Intel Ethernet Server Adapters; competing products offer no DMA Coalescing at all.

Network Utilization 25 Percent and Higher: Low Component Power

While particularly dominant at higher network utilization levels, low component power is a significant contributor to energy efficiency in all cases. Integrated quad-port silicon, uniquely offered by Intel Ethernet Server Adapters, has significant power and component advantages, compared to a competitor's quad-port solution that requires two dual-port adapters, two controllers, and a bridge chip to coordinate all four ports.

Power Savings for the Energy-Efficient Enterprise

Traditional enterprise applications, ranging from e-mail, to web servers, to file and print, realize significant cost savings from DMA Coalescing and the other features of Intel Ethernet Power Management Technology. Depending on latency requirements, IT organizations can balance performance with power savings, another way of controlling operating expense for an ongoing competitive advantage.
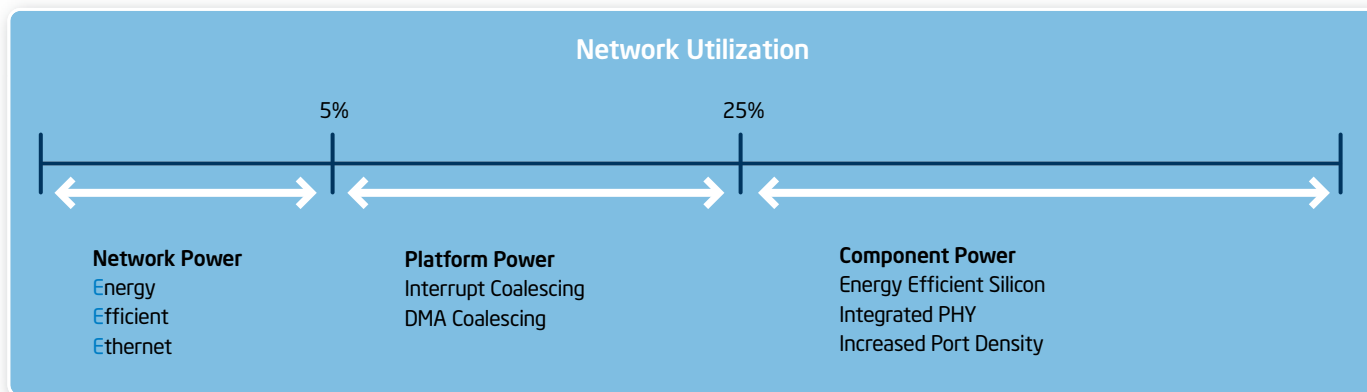

Figure 2. Different aspects of Intel® Ethernet Power Management Technology predominate at different levels of network utilization.

Learn More About Intel® Ethernet: www.intel.com/go/ethernet