Beyond the Physical Plant

Reduce Energy Usage Before It Begins

For every 1 watt used by Gigamon optimization, up to 11 watts or more can be saved from tools.[1]

Introduction

Data centers are the backbone of modern computing and the internet, including the public cloud, with massively scaled data centers operated as a service for end customers. Whether cloud-scale or a simpler server room, these facilities house servers, storage devices, and networking equipment that power the digital services we rely on every day. However, data centers are also among the largest consumers of electricity, and that energy consumption has a significant impact on the environment via its carbon footprint. Therefore, energy savings are critical for data centers to reduce their environmental impact and ensure sustainable operations.

Importance of Energy Savings

The importance of Energy Savings in data centers cannot be overstated. Data centers are responsible for approximately 2 percent of all global carbon emissions,[2] and this figure is expected to increase as the demand for digital services grows. Compare this figure to 3.6 percent of global carbon emissions from the chemical and petrochemical industry.[3] Furthermore, energy costs are a significant expense for data centers, and reducing energy consumption can result in substantial cost savings. Energy costs have been on the rise globally since 2020 and are forecasted to stay elevated through at least 2024.[4]

Traditional Strategies for Energy Efficiency

Data centers typically implement several strategies to reduce energy consumption and save on operational costs. Many system and silicon vendors have introduced more energy-efficient hardware, such as servers and storage devices with lower power consumption, variable fans, and so forth. Data centers can also optimize their cooling systems to reduce energy consumption by implementing free cooling, raising the operating temperature of servers, and using thermal management techniques such as hot aisle/cold aisle containment. Some data centers have been constructed in colder weather environments, reducing the burden on cooling. Additionally, data centers can incorporate renewable energy sources such as solar, wind, or hydropower to reduce their carbon footprint and promote sustainability.

Hidden Costs, Hidden Carbon

Many data center operators focus on physical plant management, taking the underlying traffic processing as a given. However, some of this traffic processing is not necessary. Organizations of all sizes should explore the hidden costs and hidden carbon impact of the tooling that surrounds core data center operations. All data centers use various security and monitoring tools to capture data communications via network traffic. Many organizations use dozens of separate tools deployed in clusters of multiple individual appliances and/or as virtualized tools running in traditional servers. The costs of operating these tools add up. For example, one of the popular network analytics probes used across service providers and enterprises can use up to 586 W of power consumption to process 16Gbps of network traffic. Monitoring 100Gbps of data center traffic would therefore require seven individual probes, consuming up to 4100 W of power. A year's worth of monitoring with this one tool requires up to 35,934 kWh, the equivalent of roughly 100 home refrigerators. See Table 1 for a summary of both the costs and carbon impact of running security and monitoring tools at scale in the data center.

Annual Power Usage, Energy Costs, and Carbon Emission for Individual Tools[5]

Security & Monitoring Tools	Power draw for one probe/sensor	Total power usage (kWh)	Energy costs[6] (USD)	Carbon emission[7] (kg CO2e)
Network analytics probe (NPM/APM)	586 W per 16Gbps	35,934	$7,187	11,391
Intrusion prevention (IPS)	193 W per 6.3Gbps	27,051	$5,410	8,575
Network detection and response (NDR)	426 W per 16Gbps	26,122	$5,224	8,281
Network forensics	252 W per 4.8Gbps	46,358	$9,272	14,695
Data loss prevention (DLP)	183 W per 2.9Gbps	56,108	$11,222	17,786

Table 1. Estimated annual power usage, energy costs, and carbon emission for individual tools. Power draw wattage determined assuming engineered capacity typically as 80% of max capacity.

Strategies to Reduce Power Usage in Tooling

Like the old adage, "Reduce, Reuse, Recycle," the best way to save is not to use in the first place. Taking a more intelligent approach to what network traffic is processed by which tools can result in substantial reduction in power usage.

Let's look at just five popular methods for traffic and energy reduction:

- **Application filtering:** Application filtering identifies well-known applications by traffic signature, even when encrypted. Create a triage system of high-risk and low-risk data by filtering out traffic from high-volume trusted applications, like YouTube or Windows Update.
- **De-duplication:** Analyze each network packet only once. Data center networks today are structured with high degrees of resiliency and redundancy in order to ensure always-on operations and availability. However, this approach also creates duplicate packets across the network, meaning that analytics tools might see two to four times more traffic than is actually created at the end-user level. De-duplication is a method to identify and remove duplicate packets before sending to tools.

- **Application Metadata:** For prominent use cases like digital forensics, storage can be significantly optimized by capturing only the Application Metadata out of network traffic, instead of capturing (and storing) the entire packet, while still identifying protocol metadata (eg, DNS), application ID, round-trip times, and more

- **Flow mapping:** Flow mapping sends specific subnets, protocols, VLANs, etc., of traffic to particular tools. That lets you send only the relevant network traffic each tool needs. For example, an email security appliance would need to see only email traffic.

- **Flow slicing:** Flow slicing is a highly efficient optimization method that drops non-initial packets in every user data session. Many tools only need to see initial setup, header, and handshake information and do not need to see every packet (video frames, for example). Real-world deployments reduce tool traffic by 75 to 95 percent.

Putting Energy Savings into Practice

Combinations of the above strategies drive very high efficiency in tool usage, reducing how much traffic they process and reducing the number of tool instances needed. If the tools are physical appliances, fewer boxes are needed. If the tools are virtualized, the savings are typically even greater, as general compute is usually less efficient than dedicated hardware for these types of analytics.

Gigamon has many years of experience increasing the efficiency of network tooling, starting with the creation of the network visibility market category. Now, that efficiency can be extended across physical, virtual machine, and container environments, as well as across on-premises data centers, colocation centers, and the public cloud. Providing this network-level depth (from Layer 2 to Layer 7 in the OSI stack) to a full tools stack creates a Deep Observability Pipeline that yields Energy Savings as well as better insights.

Global Summary of Gigamon Benefits

	1 year	3 year	5 year
Power Consumption From New Tool Instances w/o Gigamon (KWh)[5]	146,178	450,325	997.790
Power Consumption From New Tool Instances with Gigamon (KWh)[5]	**–**	**12,352**	**125,443**
Percentage Reduction with Gigamon[5]	**100%**	**97%**	**87%**
Emissions From New Tool Instances w/o Gigamon (Kg CO2e)[7]	46,338	142,753	316,300
Emissions From New Tool Instances with Gigamon (Kg CO2e)[7]	**–**	**3,915**	**39,765**
Percentage Reduction with Gigamon[7]	**100%**	**97%**	**87%**
Energy Cost From New Tool Instances w/o Gigamon (USD)[6]	$9,268	$28,551	$63,260
Energy Cost From New Tool Instances with Gigamon (USD)[6]	**$0**	**$783**	**$7,953**
Percentage Savings with Gigamon[6]	**100%**	**97%**	**87%**

Table 2. Global summary of estimated Gigamon benefits for new instances of existing tools.

Estimated Energy Consumption from Tool Capacity Expansion

(100G Network, 6 tools, 35% growth[5])

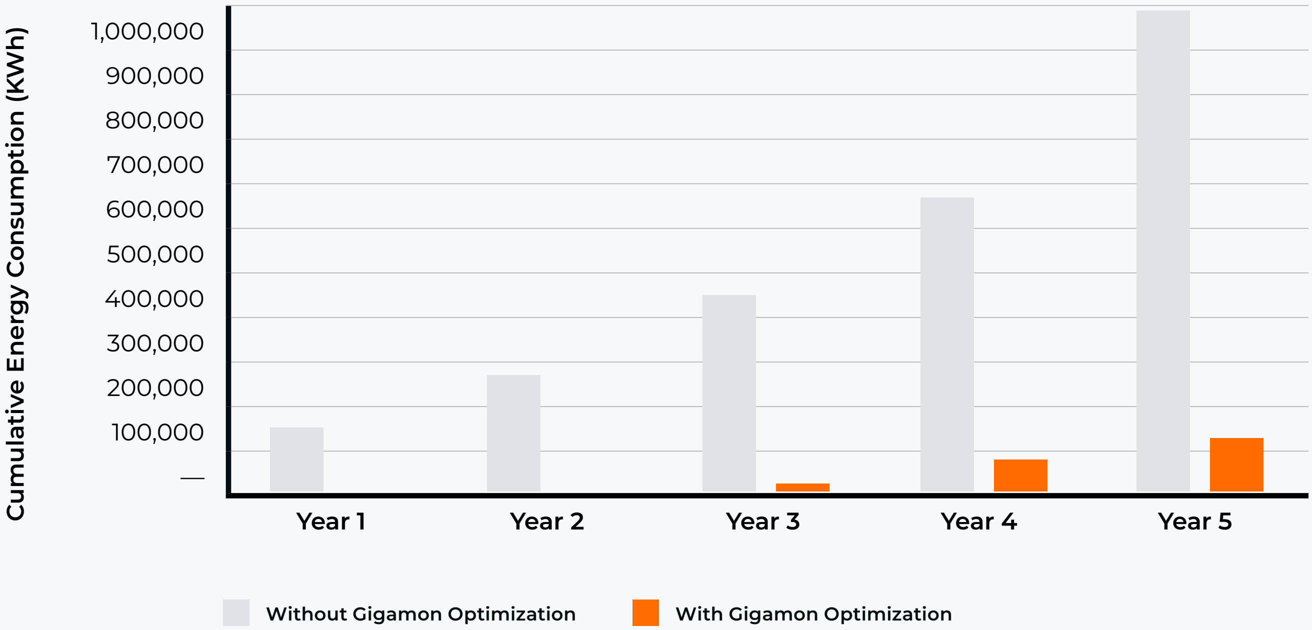

Table 3. Example of carbon reduction and energy savings with Gigamon Deep Observability Pipeline for capacity expansion of new instances of existing tools.[5]

Table 2 and Chart 1 depict two different views of the same example model for energy reduction, which leads to carbon reduction and energy cost savings from using the Gigamon Deep Observability Pipeline. This example assumes that six types of tools are in place, sized to current traffic needs. As traffic grows, the efficiency strategies described above can minimize the need for new tools by getting much more leverage out of the existing installation.

Calculating Energy Savings from a Deep Observability Pipeline

Each environment is different, with different infrastructure and different tooling. Gigamon created a energy savings calculator into which organizations can input their specific information to see how much energy efficiency is achievable, calculating the corresponding cost savings and reduced carbon footprint. As a rough guide, for every 1 watt of Deep Observability Pipeline pre-processing, 5 to 11 watts of downstream tool power draw can be reduced.[8] And this can go much higher than 11 watts when more than one tool is involved. Certain tools can see a 95 percent reduction in traffic through the combination of filtering, de-duplication, and application metadata. Other tools that may prefer to see nearly all traffic may see only a 25 percent reduction through modest use of filtering. In all scenarios, organizations can better manage and measure power usage in the tooling infrastructure.

Conclusion

In addition to returning cost savings from reduced energy usage, energy savings demonstrate a commitment to sustainability and environmental responsibility. Energy savings in data centers of all types mitigate environmental impact, save on operational costs, and promote sustainability. Best-in-class organizations go beyond the physical plant and use intelligent capabilities like a Deep Observability Pipeline to reduce and consolidate at the source, avoiding downstream energy-intensive processing. Root out these hidden costs and hidden carbon impact by getting the right data — and only the right data — to security and monitoring tools.

To request an energy savings assessment for your organization, send a email to NEAT@gigamon.com.*

About Gigamon

Gigamon offers a deep observability pipeline that harnesses actionable network-level intelligence to amplify the power of observability tools. This powerful combination enables IT organizations to assure security and compliance governance, speed root-cause analysis of performance bottlenecks, and lower operational overhead associated with managing hybrid and multi-cloud IT infrastructures. The result: modern enterprises realize the full transformational promise of the cloud. Gigamon serves more than 4,000 customers worldwide, including over 80 percent of Fortune 100 enterprises, nine of the 10 largest mobile network providers, and hundreds of governments and educational organizations worldwide. To learn more, please visit gigamon.com.

* Results may vary depending on the infrastructure and solution deployment.

1 11 watts value comes from a comparison of a single HC3 GigaSMART module consuming 250W being used to reduce 2,680W of probe energy. This is based on a model using the network analytics probe from Table 1, for 100Gbps peak network traffic, using flow slicing with 75% traffic reduction, to reduce the number of probes needed from 7 down to 2, saving energy from 5 probes @ 586W each.

2 Forbes Tech Council, May 2021.

3 Environmental Protection Agency

4 World Bank, Commodity Markets Outlook, 2022

5 Reflects cumulative annual consumption of new tools for a 100Gbps network with 35 percent annual traffic growth, six tools, and an average traffic reduction from Gigamon of 71 percent. Assumes no existing tools are shut down. Power draw wattage determined assuming engineered capacity typically as 80% of max capacity.

6 Energy cost calculation uses a default value $0.20 per kWh. Table and chart figures rely on this conversion rate. This figure can vary greatly by region, energy source, and other factors. In Europe, electricity prices can be much higher, with Germany, UK, Italy, Denmark, and Belgium all exceeding $0.40 per kWh in June 2022, the latest freely available dataset from globalpetrolprices.com, who tracks global pricing for various forms of energy. In that same month, the average cost in the United States was $0.16 per kWh, according to the U.S. Bureau of Labor Statistics.

7 C02 conversion uses 0.317 kg of C02 emission per kWh, based on averaged figures from carbonfund.org. This will also vary depending on the energy source. Table and chart figures rely on this conversion rate.

8 Gigamon modeled energy savings for 100Gbps peak network traffic for three different optimization techniques: Flow Slicing, Application Filtering, and Deduplication, using typical reduction values. Energy savings were modeling for both Gigamon's HC3 and HC1-Plus platforms, across five different security and monitoring tools. Models assumed only one tool in use in each case, and no additional traffic reduction from flow mapping or other filtering. Ratio of tool energy saved to Gigamon energy consumed ranged from 1.6x to 18x, with a median value of 5.6x. Use of multiple tools or additional filtering can significant increase these energy savings per watt used by Gigamon.

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