EMPOWERING ENERGY EFFICIENCY IN FEDERAL DATA CENTERS

DATA CENTER CONSOLIDATION INITIATIVE

Jerry Rutkowski
Martin Anderson
Michelle Hazelton
1E

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ABSTRACT: THIS DOCUMENT DISCUSSES THE FEDERAL DATA CENTER CONSOLIDATION INITIATIVE AND DESCRIBES AREAS WHERE GREATER ENERGY EFFICIENCY AND CARBON REDUCTIONS CAN BE ACHIEVED USING A NUMBER OF QUICK WINS.

Contents

Introduction

According to research conducted by Gartner[1], energy use from servers, desktops, monitors and laptops is the largest single category of IT energy consumption in the United States, accounting for 48% of all IT electricity costs. Based on the Environmental Protection Agency (EPA) and the Department of Energy (DOE) estimates, the 11.8 million servers currently installed in the United States[2] represent 1.5% of all U.S electricity consumption (some 61 billion kWh of electricity in 2006)[3].

"An organization with 5,000 servers stands to save $4M through server rationalization and power management."
Alliance to Save Energy, Server Energy & Efficiency Report '09[4]

Here in the U.S. 15% of those servers are unproductive or unused, according to the Alliance to Save Energy, wasting over 3 million tons of $C0_2$ every year alone (equivalent to the carbon dioxide emissions of 580,678 cars) and needlessly costing US taxpayers $4,400 every year, for every server, in additional costs[3]. In a Federal agency with 10,000 servers, that's over $6.6M a year in unnecessary spending[5].

And these concerns have been echoed by Vivek Kundra, Federal Chief Information Officer, when he set out the Federal Data Center Consolidation Initiative in a recent memo to Federal CIOs. In that memo he warned that energy consumption across Federal data centers could rise as high as 12 billion kWh by 2011 without a fundamental shift in how technology is deployed, adding that, "*the growth in redundant infrastructure investments is costly, inefficient and unsustainable and has a significant impact on energy consumption*."[6]

"4.7M servers are not doing any useful work, wasting nearly $21B per year on hardware, maintenance and management, with an extra $3.8B wasted on energy." **Alliance to Save Energy, Server Energy & Efficiency Report '09[3]**

Federal Data Center Initiative

On February 26, 2010, **Federal Chief Information Officer Vivek Kundra** issued a memorandum to all CIOs announcing the Federal Data Center Consolidation Initiative.

The memo outlines the urgent need for a fundamental shift in how technology is deployed due to the substantial growth in redundant infrastructure. The reported number of Federal data centers grew from 432 in 1998 to more than 1,100 data centers in 2009[5].

In 2006, Federal servers and data centers consumed over 6B kWh of electricity and without a fundamental shift in how we deploy technology it could exceed 12B kWh by 2011. ***EPA Report on Server and Data Center Energy Efficiency 2007[2]***

The Initiative aims to address these challenges by leveraging best practices in the public and private sector. The focus of this initiative is to:

- Promote the use of Green IT by reducing the overall energy and real estate footprint for government data centers
- Reduce the cost of data center hardware, software and operations
- Increase the overall IT security posture of the government

- Shift IT investments to more efficient computing platforms and technologies

The Federal CIO Council Sponsors are Richard Spires, CIO for the Department of Homeland Security and Michael Duffy, CIO for the Treasury Department.

IT asset utilization

IT asset utilization is the key driver for reducing energy consumption per unit of performance. The primary benefit to agencies is reduced overall energy consumption which in turn leads to significant energy cost savings, reduced facilities maintenance and operational costs, reduced server maintenance and operational costs and improved automation for server management and provisioning[7].

This can be achieved primarily by:

- Server Virtualization by increasing the number of virtual servers per hosts
- Server Consolidation by decommissioning underutilized physical servers
- Rack Space Consolidation by relocating underutilized racks
- Data Center Consolidation by shutting down underutilized facilities

As many as 10-15% of servers may be inactive but still powered on in data centers. ***McKinsey Report: Revolutionizing Data Center Efficiency 2008***[8]

Data Center Consolidation Initiative Deadlines

The following processes have been devised to collect information that will drive the data center consolidation plans:

- Initial Asset Inventory: Agencies will conduct an initial inventory of data center assets by April 30, 2010.
- Initial Data Center Consolidation Plan: Agencies will develop an initial data center consolidation plan by June 30, 2010.
- Final Asset Inventory Baseline: Agencies will collect the final asset inventory baseline containing more detailed information by July 30, 2010.
- Final Data Center Consolidation Plans: Agencies will develop their final data center consolidation plans and incorporate them into their 2012 fiscal year budgets by August 30, 2010.
- Ongoing Monitoring.

Where 1E can help

With deadlines looming, the first steps are establishing your baseline for Server and application inventory, increasing application usage awareness, and understanding power consumption so that realistic targets can be set. With intelligent reporting 1E's Server Reduction and Consolidation Solutions can deliver a significant and immediate reduction in the number of physical and virtual servers deployed across your agency.

Data Center Consolidation & Server Power Management

NightWatchman® Server Edition is the key to making data centers and servers more efficient by reducing power consumption and redundant infrastructure and by avoiding future capital spending on new hardware. NightWatchman Server Edition revolutionizes the measurement of power usage and activity across both physical and virtual Windows and UNIX / Linux servers. It provides continual analysis on how much power is being used by business applications and how much is being wasted on idle or non-productive work.

Useful Work™ tracks the productivity of physical and virtual servers, reporting on how much power is being wasted by idle or unproductive processes and comparing that with power consumption by business applications[9]. If the server is busy doing the task for which it was bought and provisioned, then it is performing useful work; if it is busy doing anything else, however important, then it is performing non-productive work. For example, a SQL Server doing SQL processing is performing useful work since users and/or applications will typically access SQL. The same server performing self maintenance tasks such as Anti-Virus scanning, Indexing, or Back-up, although important, is not doing useful work since it is not directly serving end users.

In the findings of the 1E / Alliance to Save Energy independently commissioned research, the Server Energy & Efficiency Report, it was found that up to 15% of servers are not doing anything useful[1] and can therefore be decommissioned or repurposed.

For example, an agency with 10,000 PCs would require approximately 1,000 servers.

*Achieving a **15% reduction** in servers (150) will deliver savings of $4,400 per decommissioned server in management and administration costs[10], equating to **an immediate savings of $660,000**, and will **reduce CO_2 emissions by 631 tons.** This is equivalent to the carbon absorbed by 14,700 trees, and results in an additional cost reduction of **$105,000** per annum on electricity[11].*

Drowsy Server® dynamically controls energy consumption and costs when no useful work is being performed, while keeping the server available if it is needed, savings from using Drowsy Server can be up to 12%[12].

*A nominal 33% - 50% of a Server estate is readily capable of achieving a **12% reduction in energy consumption.** From the remaining 850 servers this would yield savings of approximately **215 tons of CO_2 emissions**, equivalent to the carbon absorbed by **5,000 trees** and a subsequent cost reduction of **$36,000** per annum on electricity[13].*

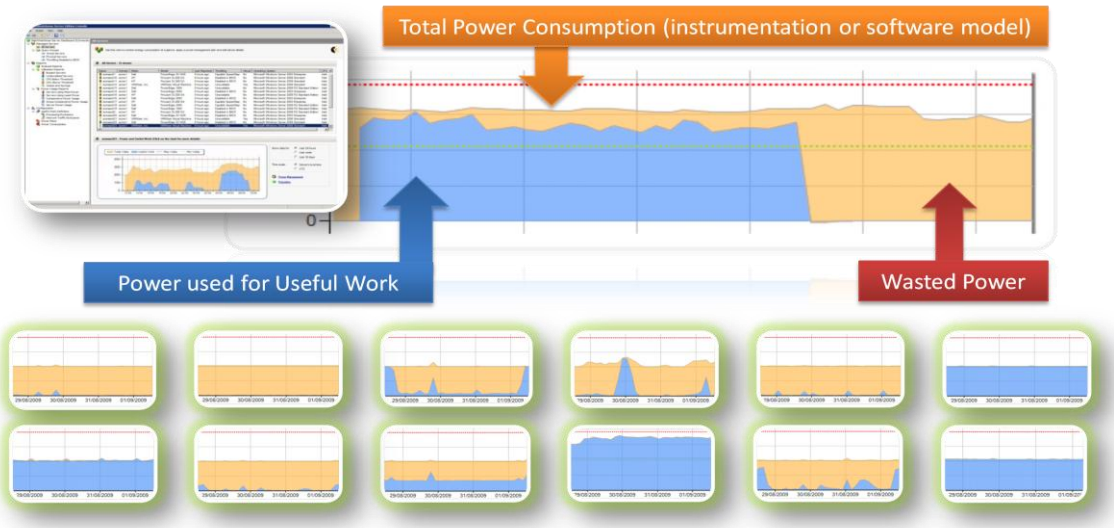
Employing both Useful Work and Drowsy will bring the total savings to approximately 846 tons of CO_2 with a total cost reduction of $801,000 per annum in electricity, management and administration costs[14].

Useful Work™

Useful Work tracks the productivity of applications across physical and virtual servers, reporting on how much power is being wasted by idle or non-productive processes and comparing that with power consumption by critical applications.

Benefits

- Immediately lowers licensing, maintenance, power and cooling costs by quickly identifying 'quick win' targets for decommissioning and consolidation across your server estate.
- Point & Click deployment of software agents across the server estate, fast roll-out with not additional hardware costs or impact on servers.
- Reports across physical and virtual servers, helping to reduce Virtual Sprawl™.
- Instant visibility dashboards and reports enable monitoring and reporting on energy consumption, cost, efficiency and CO_2 emissions for all servers or those grouped by location, department, manufacturer or application.
- Employs a highly accurate and sophisticated power modeling algorithm to provide in-depth analysis and reporting and 'what if' recommendations.
- Enables delivery of baseline power and efficiency audit in thirty days or less, and displays wasted energy at a glance. Each graphic below represents an actual server in a real customer environment. The blue area represents Useful Work, and one can determine which servers are candidates for decommissioning, repurposing or virtualization, as well as perhaps which servers are over utilized.



Quick Wins

- Instant visibility dashboards and reports help identify likely potential savings through server decommissioning, based on recommended scenarios.
- Monitoring and identifying servers with zero utilization helps in the selection of possible candidates for rationalization, virtualization or decommissioning.

- Tracking application productivity helps to identify unproductive servers and unused business applications, aiding prioritization and further selection for decommissioning.

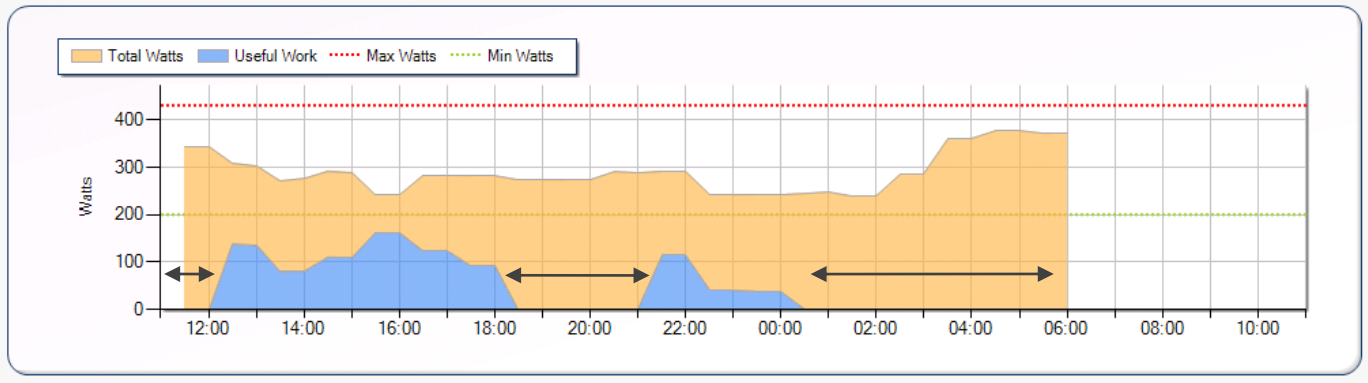
For an in-depth explanation of Useful Work read the white paper: Useful Work: The Lights are ON, but is anybody Home? Available here: http://www.1e.com/download/whitepapers/Usefulwork.pdf

Drowsy Server©

Drowsy Server DYNAMICALLY controls server processor performance to minimize energy consumption and costs when no 'useful work' is being performed, while keeping the server available if it's needed to quickly adapt to additional demand.

Benefits

- Processors running at lower speeds generate less heat and consume less power, so costs are reduced.
- Processors are not running 'hot' 24x7x365 so processor life is extended, reducing upgrade/replacement costs and TCO.
- Dynamically adjust speed as processor burden changes, maximizing power reductions while maintaining performance when needed.
- Maximizes achievable savings while still ensuring that servers are able to react to demands to perform Useful Work™. The arrows below show the times Drowsy Server will dynamically take effect, when the server is doing no Useful work.



Quick Wins

- Instant visibility identifies likely potential power savings through Drowsy Server implementation, based on recommended scenarios.
- Monitoring and identifying servers with low utilization or seasonal peaks and troughs in demand helps in the selection of possible candidates for dynamic power management.
- Improves cooling capacity by dynamically controlling power usage while keeping servers available if they are needed.

For an in-depth explanation of Drowsy read the white paper: Drowsy – The 8th Dwarf. Available here: http://www.1e.com/download/whitepapers/Drowsy.pdf

For additional information on how 1E can help with the Data Center Consolidation Initiative please visit: http://www.1e.com/federal/DataCenters.aspx

Timeline to Savings

Any Federal agency can achieve a Return-on-Investment within twelve months, with million-dollar cost savings through NightWatchman Server Edition, but 'quick wins' can deliver initial savings much faster.

NightWatchman Server Edition can baseline current server utilization across any Federal agency data center(s) in just 30-days, delivering a written report of our analysis and recommendations. Based on this report 1E will be able to easily identify and recommend physical and virtual servers as suitable candidates for decommissioning, based on the likely savings available to ensure you maximize initial savings. These initial changes can save organizations millions of dollars in their first year of impact.

We can then make further recommendations based on the likely power savings available through the implementation of Drowsy Server Dynamic Power Management.

Conclusion

The strategic objectives and tactical opportunities laid out under the Data Center Consolidation Initiative oblige Federal agencies to focus on the following:

Reducing costs, by:

Reducing Operational Costs

By reducing numbers of physical servers, by improving efficiency and utilization and by driving virtualization, Federal agencies can make a significant contribution to reducing operational costs - if each server costs $4,400 a year to manage, removing 150 servers saves $660,000[3] (this does not include energy costs for powering and cooling the server).

Reducing Energy Use

By identifying physical servers suitable for decommissioning, Federal agencies can make a significant impact on energy use - if each server costs around $700 to power and cool every year, removing 150 servers can save a further $100,000 a year in energy costs[15].

Limiting Long-term Capital Investments

By identifying servers adding no business value and decommissioning them, or by driving improved server utilization, Federal agencies can reduce the 1,100+ data centers they currently have.

Reducing environmental impact, by:

Reduce Power Consumption

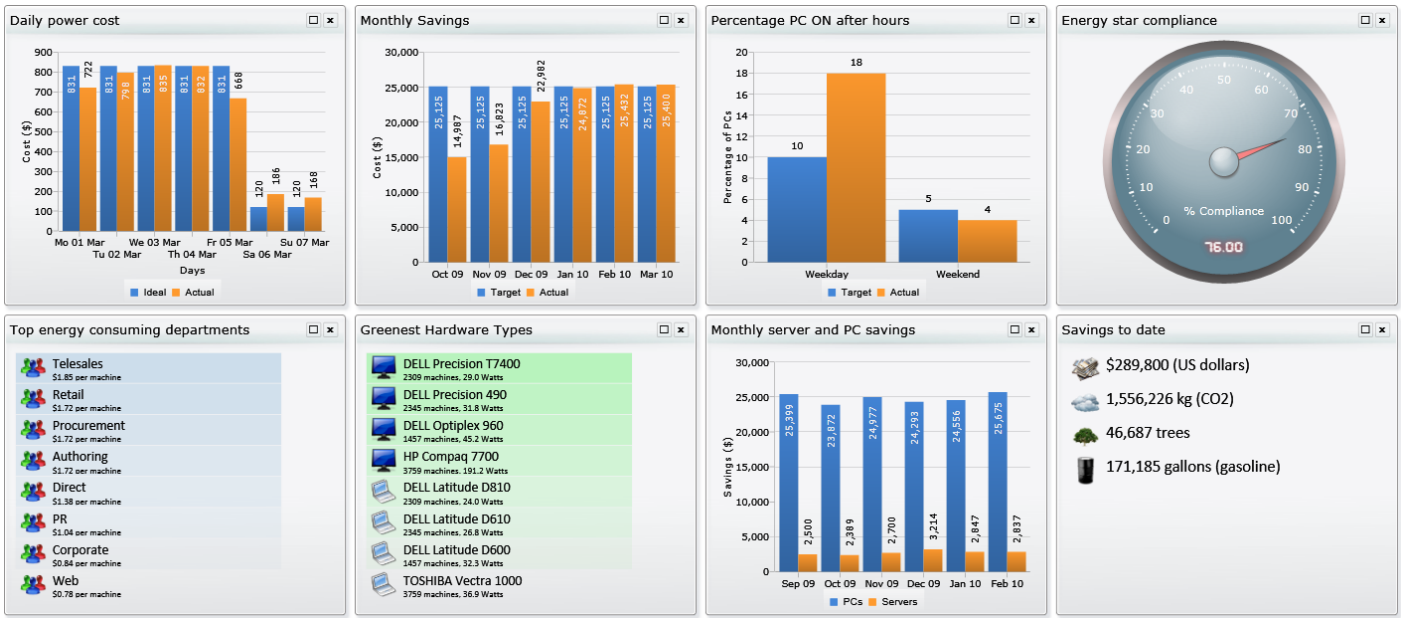
By identifying Useful Work, Federal Agencies can identify servers that have 0% or very low utilization, which can be candidates for decommissioning, or servers that have low or seasonal utilization, all of which can be candidates for dynamic power management and/or virtualization.

Improving IT Asset Utilization & Visibility:

Server consolidation and virtualization

By tracking the productivity of applications and reporting on how much power is being wasted by idle or non-productive processes, Federal agencies can identify and select servers suitable for decommissioning or virtualization, driving better utilization of existing server assets, even helping to redeploy those assets to areas of the organization where they could be better used.

The following is an example of the 'Enterprise V1EW' dashboard. This provides all stakeholders of CIOs, IT Staff, Sustainability Officers, and Energy Officers great visibility into the Server (and PC) estate.



Contact 1E

For additional information on how to contact 1E please visit http://www.1e.com/federal/Contactus.aspx

References

[1] Gartner: Forecast IT Hardware IT Hardware Energy Consumption Worldwide 2005-2012 (2008). Available from: http://rte.gartner.com/DisplayDocument?ref=g_search&id=842025

[2] IDC Worldwide and U.S. Enterprise Server 2007-2011 Forecast Update by Vertical Market and Company Size (June 2008)

[3] EPA Report on Server and Data Center Energy Efficiency (Aug 2, 2007). Available from: http://www.energystar.gov/index.cfm?c=prod_development.server_efficiency_study

[4] Server Energy and Efficiency Report (2009). Available from: http://www.1e.com/EnergyCampaign/downloads/Server_Energy_and_Efficiency_Report_2009.pdf

[5] ($145,000M / 33,000,000 servers = $4,400 per server (In 2008, approximately $145,000M was spent on new server spending and management and administration of 33M servers, according to IDC report: "Optimizing Infrastructure and Server Management in Tough Economic Times")

15% of 10,000 = 1,500

1,500 x $4,400 = $6,600,000

[6] Federal CIO Vivek Kundra, Federal Data Center Consolidation Initiative, (Feb 26, 2010). Available from: http://www.scribd.com/doc/27535844/Data-Center-Consolidation-Memo-02-26-10

[7] Data Center Consolidation Initiative Executive Briefing (Mar 15, 2010)

[8] McKinsey Report: Revolutionizing Data Center Efficiency (July, 2008). Available from: http://www.mckinsey.com/clientservice/bto/pointofview/pdf/Revolutionizing_Data_Center_Efficiency.pdf

[9] White paper: Useful Work: The Lights are ON, but is anybody Home? (2009). Available from: http://www.1e.com/download/whitepapers/Usefulwork.pdf

[10] $145,000M / 33,000,000 servers = $4,400 per server (In 2008, approximately $145,000M was spent on new server spending and management and administration of 33M servers, according to IDC report: "Optimizing Infrastructure and Server Management in Tough Economic Times")

$4,400 x 150 servers = $660,000

[11] (400 watts/server is according to Gartner study referenced above: "U.S. Data Center Conference Focuses on How to Do More With Less," Gartner, June 2, 2009)

(energy cost for running unused servers continuously for a year + cooling cost for running unused servers continuously for a year assuming a Power Usage Effectiveness value of 2, according to EPA average PUE 2.04, 2006)

Server = average 400Watts

0.4kW x 24hr x 365days = 3,504kWh x 150 servers = 525,600kWh

525,600kWh x 0.544kg CO2 = 285,926kg x 2 for PUE = 571,853kg/ 572 tonne / 631 US ton of CO_2

525,600kWh x $0.10 electricity = $52,560 x 2 for PUE = $105,120

[12] White paper: Drowsy- The 8th Dwarf (2009). Available from: http://www.1e.com/download/whitepapers/Drowsy.pdf

[13] (400 watts/server is according to Gartner study referenced above: "U.S. Data Center Conference Focuses on How to Do More With Less," Gartner, June 2, 2009)

(energy cost for running unused servers continuously for a year + cooling cost for running unused servers continuously for a year assuming a Power Usage Effectiveness value of 2, according to EPA average PUE 2.04, 2006)

Physical server = average 400Watts

0.4kW x 24hr x 365days = 3,504kWh x 850 servers = 2,978,400kWh

2,978,400kWh x 0.544kg CO2 = 1,620,250kg x 2 for PUE = 3,240,499kg/ 3,240 tonne CO2 / 3,571 ton CO2

(12% = 429 US ton CO2 ÷ 2 for 50% of servers power managed = 215 US ton CO2)

2,978,400kWh x $0.10 electricity = $297,840 x 2 for PUE = $595,680 (12% = $71,482 ÷ 2 for 50% of servers power managed = $35,741)

[14] 631 + 215 = 846 tons CO_2

$660,000 + $105,000 + $36,000 = $801,000

[15] (400 watts/server is according to Gartner study referenced above: "U.S. Data Center Conference Focuses on How to Do More With Less," Gartner, June 2, 2009)

(energy cost for running unused servers continuously for a year + cooling cost for running unused servers continuously for a year assuming a Power Usage Effectiveness value of 2, according to EPA average PUE 2.04, 2006)

Physical server = average 400Watts

0.4kW x 24hr x 365days = 3,504kWh

3,504kWh x $0.10 electricity = $350.40 x 2 for PUE = $700.80

3,504kWh x 0.544kg CO_2 = 1,906kg / 1.9 tonne / 2 US ton