LANDesk Power Management

Practical Policy Considerations

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Executive Overview

LANDesk's Power Management functionality allows administrators to centrally control end-node power consumption by facilitating the creation, financial evaluation, and deployment of power management policies. While administrators centrally control the conditions under which computers and monitors stand by, hibernate, or power down, users can forestall specific power management actions via a client-side user interface (UI). In addition, a "soft" shutdown option protects unsaved user data. A pre-populated database of OEM wattage consumption values is matched to actual hardware inventory data, and available custom wattage settings allow high levels of precision in the estimation of financial and power savings.

Through improved understanding of the financial impact of specific power management actions, administrators are able to better evaluate the trade-offs between productivity and desired power savings. The ability to leverage Intel® vPro™ functionality provides a secure, reliable mechanism to remotely power-on machines for environments that don't use Wake-on-LAN.

Power Management: Balancing Financial, Environmental, and Productivity Considerations

IT administrators face a unique challenge given the current emphasis on green IT initiatives. IT's mandate to maximize system availability subtly conflicts with some voices in the power management community since the power management actions imposed on a system imply a specific period of downtime as the system returns from power-saving mode to availability. The intent of this paper is to explore the trade-offs inherent in the power management of client computers, and to recommend policy that considers all pertinent facets of the issue.

Background: Electricity Cost and Consumption Rates

LANDesk has found significant variability in the power consumption of visually similar computers and monitors. For accurate measurements we recommend tools like the Kill-A-Watt electricity measurement tool (roughly $25 online from Amazon.com), which provides a real-time readout of power consumption. For reference, we've found typical wattage usage to be as follows:

Hardware Type	Watts Used
Desktops	60 – 80 watts
Laptops	30 – 40 watts
Monitors	20 – 30 watts (flat screen); 40 – 80 watts (regular); 80 – 120+ (CRT)

In 2007, the commercial cost per kilowatt hour (i.e. the cost to draw 1,000 watts for an hour) averaged $.10/kWh in the United States (with a high of $.15 in New England and a low of $.08 in the Mountain region). [1] A typical desktop system purchased a couple of years ago is likely to use 80 - 120 watts (for both the computer and monitor). A 100-watt desktop system that operates continuously for 10 hours would use one kilowatt hour, or about 10 cents ($.10) of electricity. Twenty-four hours of continuous operation would thus cost roughly a quarter ($.24). A comparable laptop is likely to use roughly a third of the power of a desktop, with a cost of $.08 per day.

Probable Savings and the Trade-Off between Power Management and Productivity

How much can an organization save by invoking power management actions? Given recent trends indicating corporate preference for laptops over desktops, [2] let's focus on power savings available for laptops using actual wattage measurements from a Lenovo T60. Wattage consumption varies from 29 to 36 watts, depending on the number and type of applications run, as well as the screen brightness selected (which varied by six watts from the brightest to the dimmest setting).

For ease of calculation, let's assume the laptop consumes 33 watts during normal use, with a power cost of $.08/day. This means it costs $29/year to operate this laptop assuming it runs continuously (24x7x365) without any power management intervention. If the laptop is used continuously from 8:00 a.m. to 5:00 p.m. five days a week, and then placed in standby mode during all other hours, the annual electricity cost decreases to $18. If, during off hours, the machine is placed into hibernate instead of standby, the annual electricity cost decreases to $17. If the machine is powered down (turned off) during off hours, the annual cost drops to $16. For reference, the T60 laptop we tested consumed roughly six watts in standby mode and three watts while hibernating.

With savings of 38% using standby, 41% using hibernation, and 45% from the power-down scenario, wouldn't the best policy require systems to power down during off hours? At this point we should take into account the cost of decreased system availability inherent in each of the three possible power-management actions.

Once a user interacts with the keyboard or mouse, a computer returns from standby within five seconds, from hibernation in about 30 seconds, and from a complete power down (i.e. the machine reboots) in three minutes (although some sources indicate reboots can require three to five minutes). Strictly speaking, for an employee whose total compensation (salary, bonus and benefits) is $40,000 annually, his/her cost per minute is $.32 (assuming an eight-hour workday, five days per week). In contrast, the cost of electricity to operate the laptop we tested is incredibly small at $.000055 per minute (roughly one two-hundredths of a cent).

To help put that number in perspective, the cost of the $40,000/year employee's time is 5,827 times more expensive than the electricity required to operate his/her laptop. Strictly speaking, this means each time a system goes into standby it costs the organization $.03 in terms of lost employee productivity due to system downtime. How long does a computer system need to remain in standby mode to make up for (via power savings) that lost $.03 of lost productivity? The answer is 10 hours. By the same logic, a machine would have to stay in hibernation mode for more than two days to recover the $.16 cost related to the 30 seconds of associated system downtime. You'd have to leave a laptop completely off for more than 12 days to offset the three minutes of downtime inherent in a reboot.

Based on these numbers, it wouldn't make sense to employ power management functions during a typical nine-hour workday unless:

1. your power costs were significantly higher than average ($.10/kWh)
2. your average employee made significantly less than $40,000 per year in total compensation, or
3. your average system consumed significantly more power than our test laptop (33 watts)

In this scenario, it would make sense to put machines into standby after the workday is over (since from 5:00 p.m. on a workday to 8:00 a.m. the following day is 13 hours, which is greater than the 10-hour breakeven point). It also makes sense to put machines into hibernate at the end of the workweek as the 61-hour period from 5:00 p.m. Friday to 8:00 a.m. Monday equals 2.54 days, which is greater than the 2.23-day break even point associated with hibernation.

If you can re-engage your systems via Wake-on-LAN or Intel vPro that users don't experience any delay in accessing computing resources, then concerns about unproductive system downtime can be eliminated. Even so, shutting down systems for the sake of power management is conceptually problematic. Desktop systems always consume some level of power as long as they are plugged in. According to Microsoft, even PCs that have been turned off use 2.3 watts "to maintain local-area network connectivity, among other things," which is essentially the same amount consumed in hibernation mode. [3] With this understanding, turning your desktop off to save power really doesn't make any sense.

However, turning off the display is a different story. Monitors typically reactivate in less than a second after having been turned off to save power. The T60 laptop tested operates on about 25% less power when the display is turned off. So even when putting machines into standby or hibernate isn't practical, turning off the monitor is a reasonable way to decrease power consumption without unduly impacting productivity.

One final note on interruption science is warranted. Research indicates that interruptions that occur at the beginning of a task are the most disruptive, which legitimizes concern regarding the five-, 30-, and 180-second delays associated with power management actions. [4] Practically speaking, the five seconds required to engage a system from standby may be short enough that users will tend to incorporate the wait into their process of completing any computer-related task. But it does seem likely that the 30-second delay associated with hibernation is long enough that it can lead to a loss of focus and negatively impact productivity.

Recommendations

If conserving power were our only objective, the best way to decrease power consumption would be to simply unplug all our computers and walk away. Clearly, that isn't our only objective. Our real goal is to decrease energy consumption without negatively impacting user productivity. If employees are highly compensated (over $80,000/year), and use laptops (which consume one-third the power of a desktop), power management policies should be very conservative. For the average knowledge worker, invoking any power management action (beyond turning monitors off) during normal work hours is counter productive. Generally speaking, a single policy putting machines into standby after a specific period of inactivity after normal work hours is the most straightforward and practical way to approach power management. Apple laptops ship with a default policy to enter into standby after 10 minutes of inactivity. LANDesk wouldn't recommend an inactivity trigger less than that, and if you want to invoke power savings after such a short period of time, turning off monitors is your best bet. Hibernation is, practically speaking, as effective as powering down a desktop in terms of saving power, and has much less of an impact on productivity. Hibernation is better than standby for off-hour periods when systems can be centrally reactivated via Wake-on-LAN or Intel vPro prior to system engagement by the user.

Conclusion

LANDesk has provided centralized management of power management policies to customers of LANDesk® Management Suite since January 2007. We are introducing our new module (to be released in the third quarter of 2008) with reporting features to meet the requests of customers for a tool that allows administrators to understand the specific financial impact of proposed power management policies. LANDesk tools provide the functionality necessary to conduct prudent power management and help administrators effectively manage the trade-offs between power savings and system availability. A beta version of the product is currently available to maintenance-paying LANDesk Management Suite 8.8 customers.

For more information, please contact your LANDesk solutions provider, or call LANDesk at 1-800-982-2130.

References

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[3] "Do you need to turn off your PC at night?" http://www.microsoft.com/smallbusiness/resources/technology/hardware/do-you-need-to-turn-off-your-pc-at-night.aspx

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