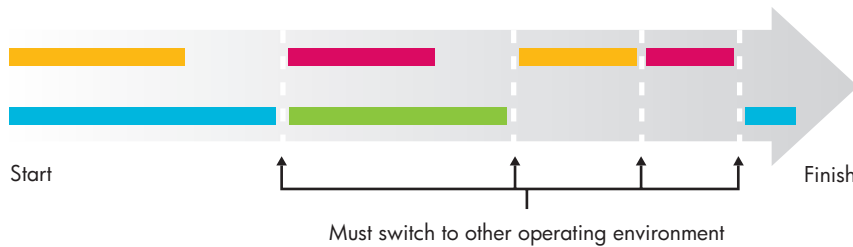# ECONOMICAL IT & ENERGY

INTRODUCTION

HP's Z800 enables professional graphics applications to run at near native performance inside of virtualized guest operating environments. This is a new capability in the industry, and provides a better way for some customers to deploy their IT. HP enabled this capability by integrating several key partners' technologies into HP's Z800 Workstation: Intel® Virtualization Technology for Directed I/O (Intel® VT-d), NVIDIA's SLI® Multi-OS technology, and Parallels Workstation Extreme's (PWE) FastLane architecture.

This paper describes an example of the economic and energy benefits that may be realized when deploying a Z800 with PWE.
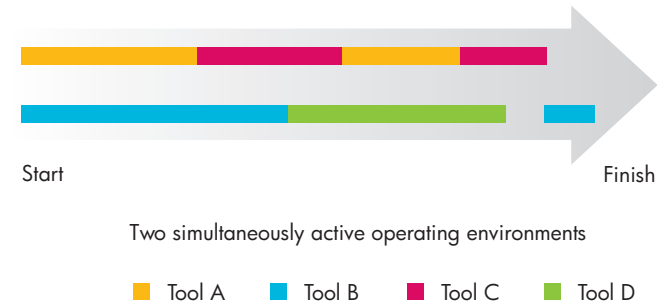
BACKGROUND

Professionals use high-end analysis, modeling, and otherwise creative applications as tools to do their job. The way in which the professional uses these tools defines their *workflow*. If the user's tools can run in the same operating environment – operating system, runtime libraries, graphics card, drivers, and patches – then we will call that a *single workflow* scenario. If the workflow's tools have different operating environment requirements – some tools run in one environment while other tools run in a different environment – then the user's workflow is effectively split in two and we will call that a dual *workflow* scenario.

Partly-Serialized Dual Workflow

Overlapping & Multi-tasking Dual Workflow

Start   Finish

Must switch to other operating environment

Start   Finish

Two simultaneously active operating environments

▮ Tool A   ▮ Tool B   ▮ Tool C   ▮ Tool D

In a *dual workflow* scenario, the user could run on a single computer system and reboot the system to switch which part of the workflow they are working on. As depicted above by the left-most diagram, to work in this manner may inhibit multi-tasking efficiencies, decrease productivity and increase time to results. The *dual workflow* scenario we consider here is one where the user has all tools available at all times; that is, the user has access to two systems that are running two different operating environments, and is depicted by the right-most diagram above.

WHAT'S COMPARED

In this paper, we compare the cost and power requirements for two similarly-configured *single workflow* Z800 workstations, against one dual workflow Z800 configured with a Parallels' Workstation Extreme (PWE) virtualized guest. To make the comparison straightforward, the *dual workflow* Z800 is configured twice as big as each *single workflow* Z800 in terms of 3D graphics, memory, hard disk, and CPU sockets/cores. The *dual workflow* Z800 then has ½ of its resources assigned to the Parallels guest operating environment. The assignment of memory and cpu cores to the guest operating environment can be adjusted on the *dual workflow* Z800 depending on the needs of the workflows in the guest environment. The allocation of cores and maximum memory are done before the guest operating environment starts; even so, the PWE engine then manages the use of the guest's resources in a fairly lean way.

WHY IT MATTERS

As implied above, users working in a *dual workflow* scenario can realize improvements in their **productivity** due to their ability to better multitask, overlapping the use of more tools in the same span of time. If one operating environment is delivered remotely and has limited interactivity, then the user's productivity may also improve because of the near native performance realized using a PWE guest operating environment. Other productivity enhancements may be less quantifiable, coming from better work area comforts – use of space, single mouse/keyboard for both operating environments (software KVM), heat and acoustics.

An added benefit to the customer is the **initial cost savings** of deploying a single larger workstation versus two smaller workstations. Some of the smaller workstations could have been deployed at the user's desk or in a remote (backroom) location, using a desktop- or application-remoting technology to deliver the additional applications to the user's desktop. Even if a user previously had several computers to handle their workflows, they might be able to consolidate that to a single workstation at their desk which handles all of their workflow needs.

The customer may also realize **IT efficiencies** with their improved ability to deploy and maintain the users' systems, a single disk image containing all needed operating environments, combined with the ability to upgrade each operating environment independently.

An even more important benefit may be the **energy (cost) savings** moving from two (or more) workstations to a dual workflow (or multi workflow) Z800.

TEST METHODOLOGY AND RESULTS

The results will show relative acquisition costs, and power use of systems deployed in the *single* versus *dual workflow* scenarios. To measure power use in an industry-accepted manner, we chose to use the graphics component and CPU components of the Energy Star suite for the **Active** measurement. These components cause the graphics card and all processor cores to be loaded at or near 100%. We chose to take power measurements using Vista64-SP1 operating environment which should be representative of Microsoft-based environments in general, typically using more resources than other operating environments while also having good power management. Note that there is flexibility in how the calculations are done based on the amount of active (loaded) versus idle versus sleep time expected for each system. The tabulated results below assume that the system(s) are loaded heavily during normal work hours, with lighter load (offline processing, backups, virus scans, etc.) during the night; this assumption is reflected in the values chosen for Operating Hours.

Each Single Workflow Configuration			Dual Workflow Configuration		
Z800	850W 85%	Intel X5570	Z800	850W 85%	2x Intel X5570
SATA 7.2K 160G	3x 2G 1333Mhz DDR3		SATA 7.2K 320G	6x 2G 1333Mhz DDR3	
Vista64 SP1	DVD Optical	Nvidia FX3800	Vista64 SP1	DVD Optical	2x Nvidia FX3800
			add Parallels Workstation Extreme		

Single Workstation Relative Cost	$1.00			$1.75	
Workstations Used for Dual Workflow	2			1	
Dual Workflow Relative Cost	$2.00			$1.75	
Workstation Energy Use	Input Power (watts)	Operating Hours	Power Use (watt-hours)	Input Power (watts)	Power Use (watt-hours)
Off/Standby	1.9	0	0	2	0
Active	288	8	2304	506	4048
Idle	116	16	1856	185	2960
Sleep	6.8	0	0	8.4	0
Daily Energy use in W-hrs	4160			7008	
Dual Workflow Daily W-hrs	8320			7008	
Days used per week	7			7	
Weeks used per year	52			52	
Year Energy consumption in kWh	3004			2530	
Carbon Footprint in kg CO2	1043			878	

In the table above, both Off/Standby and Sleep were measured with Wake-On-LAN enabled. In this scenario, we assumed 8 intense hours of active operating mode on each system per day, 7 days per week. The yearly calculations were based on 52 weeks in a year, which is short by one or two days depending on leap-year. In addition, we assumed 3 days per year that the workstation(s) would be completely disconnected from power; for example, for servicing, upgrades, or some other reason. All of the calculations are straight-forward multiplication and addition of the energy (watts) measured in each of the different operating modes, multiplied by the duration that the workstation(s) were run in each mode. More specifically, Power Use = Input Power * Operating Hours; the Operating Hours for each phase of use – Off, Active, Idle, Sleep – can be modified to get an idea of how overall Energy Use varies with different customer usage models. Likewise, the number of days of use per week, and the number of days disconnected from power can be modified to better match a customer's use scenario.

In this example, we see that the initial acquisition cost of two single workflow Z800s is 14% higher than one dual workflow Z800. In terms of ongoing power use, the energy costs of two single workflow Z800s is 19% higher than a dual workflow Z800.

CLOSING THOUGHTS

HP Z800 + Parallels Workstation Extreme technology supports multiple guest operating environments. As of the writing of this paper, only two high-performance workflow environments can be active at a time. However, guest operating environments can be quickly suspended and resumed, making it possible to quickly transition between guest operating environments and their respective tools. You have seen an example of cost and power savings applied to the dual workflow usage model. The cost and power savings benefits are even more significant when consolidating many single workflow systems into a single multi workflow system, providing especially good incentive for customers to consider this solution for users who need to run multiple operating environments.

In addition, for workflows that do not require fully-accelerated graphics, Parallels offers a Desktop product. This provides additional guest operating environments that are well integrated with the host operating environment. No matter how many guest operating environments are active, either Workstation or Desktop varieties, Parallels enables the user to operate in the host and all guest environments with ease.

GETTING STARTED

As of June 2009, customers can order Parallels Workstation Extreme as an option on the HP Z800 Workstation. For more information:

HP Z Workstations
http://www.hp.com/united-states/campaigns/z-workstations/
http://www.hp.com/large/products/workstations.html

Parallels Workstation 4.0 Extreme
http://www.parallels.com/extreme

Intel® Workstation Processors & Virtualization
http://www.intel.com/products/workstation/processors/index.htm
http://www.intel.com/technology/virtualization/

NVIDIA SLI Multi-OS
http://www.nvidia.com/object/sli_multi_os.html