NOTEBOOK BATTERY LIFE BENCHMARK TEST REPORT

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1. Introduction

Allion Japan Inc. (“Allion”),headquartered in Taiwan, is one of the worlds leading Information Technology (IT) testing organizations that provides outstanding, cost-effective testing services for IT developers in multiple regions of Asia and North America. Allion’s testing services uses proprietary tools to identify compatibility problems between third party application software packages & hardware peripheral devices under a variety of operating systems environments. Testing procedures are comprehensive, methodical, and widely recognized. In addition, Allion conducts benchmarking tests for several computer products on subjects including inkjet printer ink quality, software usability and software functionality, and software performance.

This report summarizes a December 2008 benchmark test of battery life performance for business notebook systems.

Recently, the notebook computer environment has evolved with an increasing focus on models with longer battery life. This evolution has occurred due to the growth of mobile computing and wireless connectivity both in and out of the office. Rather than increased battery life based on an improvement of the battery itself, increased battery life has occurred due to innovations in notebook computers.

In this study, we have therefore executed battery life tests for the three leading business notebook manufacturers DELL, HP, and Lenovo.

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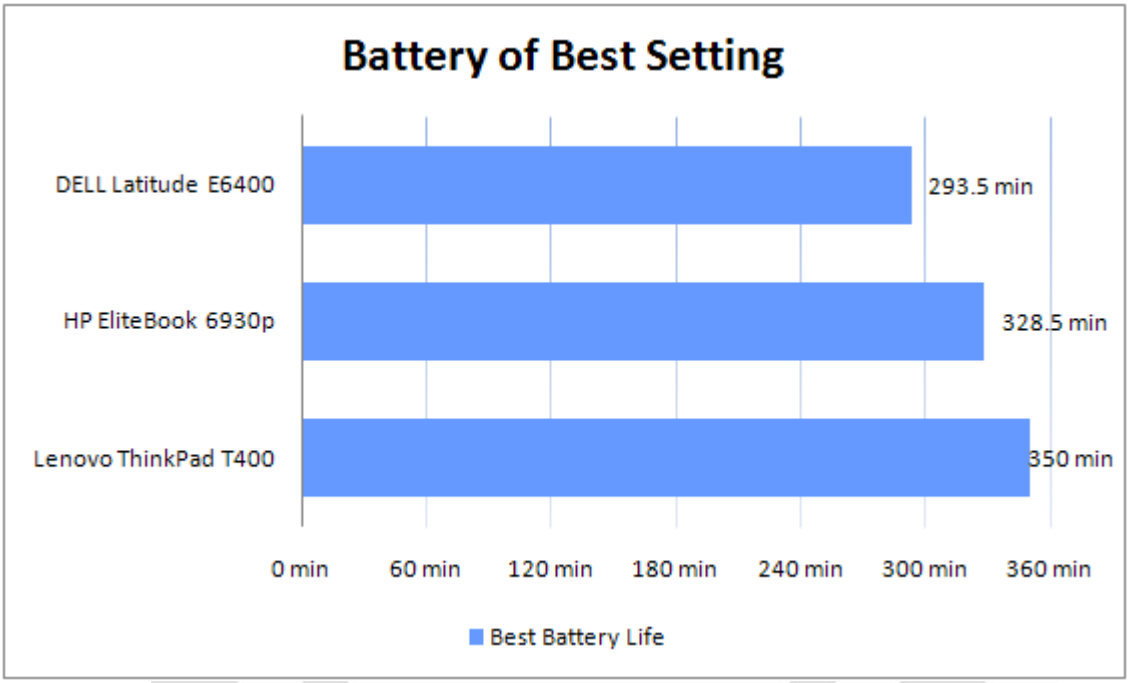
2. Conclusion

Battery-powered operation times for each notebook were measured under similar conditions using BAPCo Mobile Mark 2007. The results below were obtained.



The Lenovo ThinkPad T400 (5 hours, 50 minutes) has the longest battery-powered operation time, followed by the HP EliteBook 6930p (5 hours, 28.5 minutes), then the DELL Latitude E6400 (4 hours, 53.5 minutes).

The operation time of notebook computers depend on the electrical power consumption of installed components, but it is possible to extend the battery life by tuning of the product itself and taking advantage of proprietary software and management utilities. Consequently, when selecting a notebook computer with a focus on battery life, specifications such as CPU and chipset or installed components as well as the tuning of each PC vender are important criteria.

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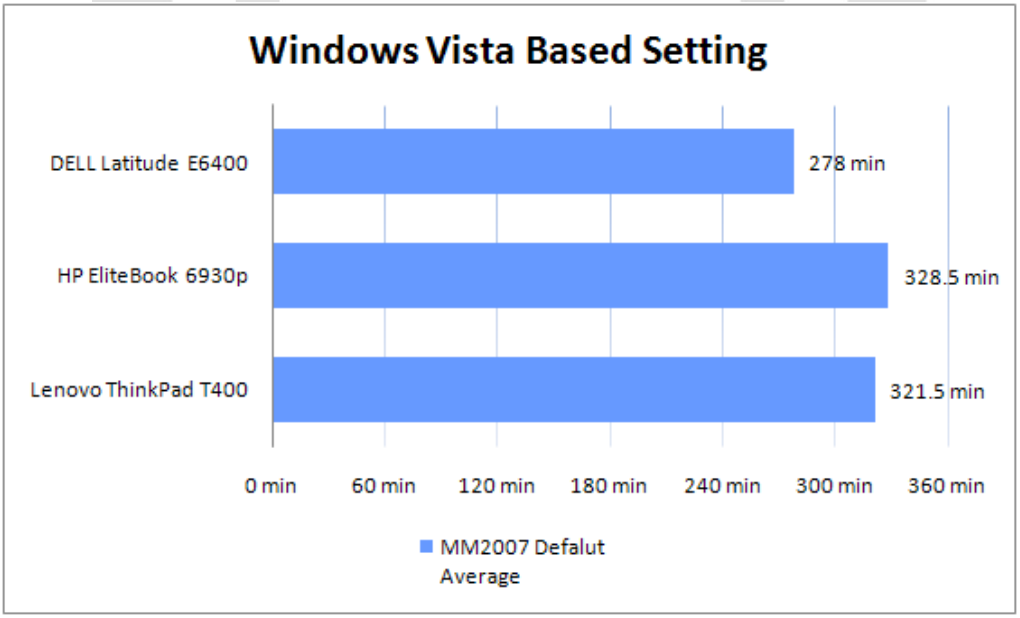
3. Test Results

3.1. Test 1: Windows Vista Based Setting

In test 1, the power management settings of each notebook computers was set to the same level and battery life was measured by using the setting tool of Mobile Mark 2007. For this test, power management was controlled by the power management function of Windows Vista. The notebooks were configured to Mobile Mark required settings and proprietary power management software was disabled.

Model Name	Lenovo ThinkPad T400	HP EliteBook 6930p	DELL Latitude E6400
MM2007 Defalut	319 min	328 min	278 min
1st Run	5:19	5:28	4:38
MM2007 Defalut	324 min	329 min	278 min
2nd Run	5:24	5:29	4:38
MM2007 Defalut	321.5 min	328.5 min	278 min
Average	5:21	5:28	4:38

<Table 1: Mobile Mark 2007 Default Setting Result>



<Image 1: Mobile Mark 2007 Default Setting Result>

The notebook computer with the longest battery life under this evaluation condition was HP EliteBook 6930p (5 hours, 28 minutes), then Lenovo ThinkPad T400 (5 hours, 21 minutes), and then DELL Latitude E6400 (4 hours,18 minutes).

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3.2. Test 2: Enable Power Utility

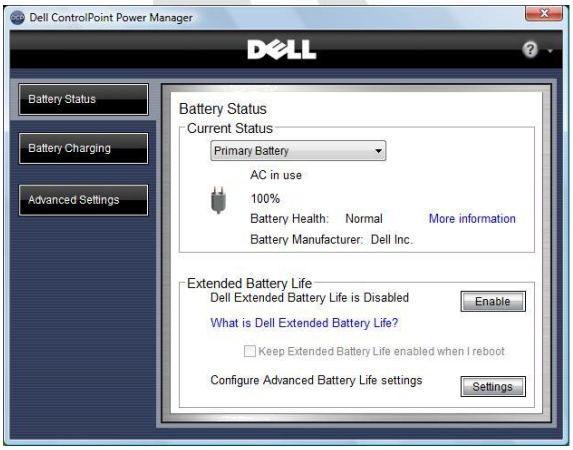
In test 2, the proprietary management software for each model was installed in each notebook computer for DELL and Lenovo. Each has setting items that the power management function of Windows Vista does not have. Using those functions, the advantage of each software were compared and the changed settings of each software ware set as described below.

The changed setting items of each software are as below.

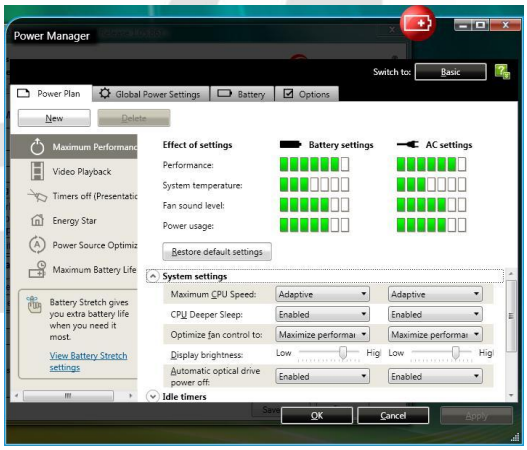
DELL Latitude E6400	Lenovo ThinkPad T400
Enable Audio Power Save Enable Power Down: CardBus, IEEE1394 Enable Power Off CD-ROM drive.	Max CPU Speed: Adaptive Fan Control: Maximize Performance Optical Drive Power Save: Enable

The DELL system contained “Reduce LCD Refresh rate”, “LCD brightness reduces during inactivity”, and “Set Color resolution to 16bits” that the Lenovo system did not have. These were excluded in order to measure the impact and advantages for both systems at parity. The HP system was excluded because it does not have such preinstalled software.

<DELL Power Manager>



<Lenovo Power Manager>



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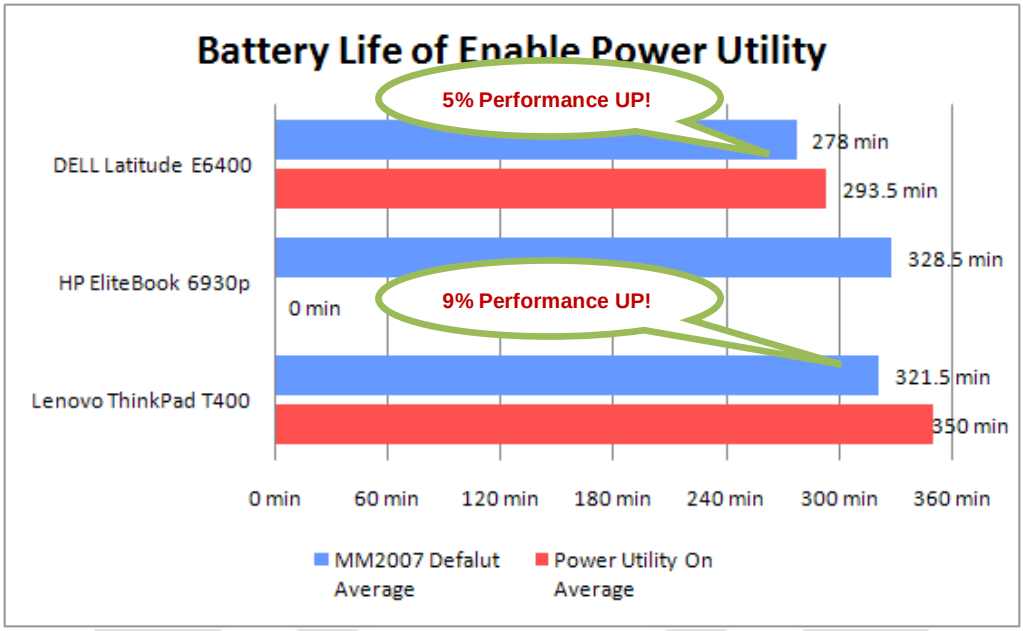
Model Name	Lenovo ThinkPad T400	HP EliteBook 6930p	DELL Latitude E6400
Power Utility On	352 min	N/A	293 min
1st Run	5:52	N/A	4:53
Power Utility On	348 min	N/A	294 min
2nd Run	5:48	N/A	4:54
Power Utility On	350 min	N/A	293.5 min
Average	5:50:30	N/A	4:53:30

<Table 2: Enable Power Management Utility Result>



<Image 2: Enable Power Management Utility Result>

Based on these tests, the Lenovo ThinkPad T400 (5 hours, 50 minutes) has the longest battery life followed by the DELL Latitude E6400 (4 hours, 53 minutes). With the advantage of the proprietary power management software, the DELL notebook computer battery life increased by 5% (extend 15 minutes), and the Lenovo notebook increased by 9% (extend 28 minutes).

It is a greater advantage that the Lenovo ThinkPad T400 power management software is already enabled in factory default; therefore it is possible to get the maximum battery life advantage without user intervention. DELL does not enable the power management software in factory default, so the user must manually configure these settings. In addition, we set the internal optical drive off for both notebook computers, However only Lenovo has the function to turn the power on when eject button is pressed again. Therefore Lenovo has this additional advantage over DELL on the usability side.

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4. Test Overview

Following is the testing environments and detailed specification of this benchmark test.

4.1. Test Environments

Category	Model Name
Test Notebook System	DELL Latitude E6400 HP EliteBook 6930p Lenovo ThinkPad T400
Battery Benchmark Software	BAPCo Mobile Mark 2007
Luminance Meter	Minolta LCD Color Analyzer CA-110

4.2. System Specification

Model Name	Lenovo ThinkPad T400	HP EliteBook 6930p	DELL Latitude E6400
CPU	Core 2 Duo T8400	Core 2 Duo T8400	Core 2 Duo T8400
Memory	2GB (DDR3/PC667)	2GB (DDR2/PC800)	2GB (DDR2/PC800)
Chipset	Intel GM45	Intel GM45	Intel GM45
Graphic Chip	Intel GMA X4500	Intel GMA X4500	Intel GMA X4500
HDD	SATA 160GB	SATA 160GB	SATA 160GB
Wireless LAN	Intel WiFi Link 5100AGN	Intel WiFi Link 5300AGN	Intel WiFi Link 5100AGN
OS	Windows Vista	Windows Vista	Windows Vista
Other Device	Bluetooth Smart Card Reader	Bluetooth Smart Card Reader	Bluetooth Smart Card Reader
LCD Brightness Setting	Level 11/15	Level 10/14	Level 6/15
Luminance	64 nit	71 nit	61.2 nit

4.3. Battery Specification

Model Name	Lenovo ThinkPad T400	HP EliteBook 6930p	DELL Latitude E6400
Battery Capacity	57Wh	55Wh	56Wh

* From label of battery pack.

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4.4. Test Method

<Test 1: Mobile Mark 2007 Default Setting>

1. Recover the system to factory default.
2. Uninstall the programs that conflict with Mobile Mark 2007.
3. Install Mobile Mark 2007.
4. Run BAPCo Auto-Configuration Tool and set the "REQUIRED" setting to run the benchmark.
5. Set the LCD brightness is set as the closest value beyond the 60 nit (Lenovo: 11/15: 75%, HP: 10/14: 79%, DELL 6/15: 40%)
6. Change the wallpaper to “img36.jpg” in the “c:Windows¥Web¥Wallpaper”
7. Turn off wireless LAN and Bluetooth.
8. Charge the battery to 100%.
9. Run Mobile Mark 2007 (Productivity) and wait until system shutdown.
10. Power on the system and check the test result.
11. Run the test two times and adopt the average of battery life.

<Test 2: Enable Power Management Utility>

Same as Test 1 expect following power management software settings.

DELL Latitude E6400	Lenovo ThinkPad T400
Enable Audio Power Save Enable Power Down: CardBus, IEEE1394 Enable Power Off CD-ROM drive.	Max CPU Speed: Highest to Adaptive Optical Drive Power Save: Enable

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