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Transmeta Corporation: BatteryMark 4.0.1 and CPUmark 99 Benchmark Results

Test report prepared under contract from Transmeta Corporation

Executive summary

Transmeta™ Corporation commissioned eTesting Labs to perform competitive benchmark tests on five notebook computers:

- NEC Versa® DayLite™ with a 600 MHz Transmeta™ Crusoe™ processor
- NEC Versa® UltraLite™ notebook with a 600 MHz Transmeta™ Crusoe™ processor
- IBM i Series ThinkPad 1124 with a 500 (AC)/300(DC) MHz Intel® Pentium® III Processor
- IBM x Series ThinkPad X20 with a 600(AC)/500(DC) MHz Intel® Pentium® III Processor
- Dell L400 with a 700(AC)/500(DC) MHz Intel® Pentium® III Processor

Transmeta™ Corporation supplied all test systems. At Transmeta's™ request we completely drained and re-charged the battery before each test run and performed all runs on battery, or DC, power. All test results for the Pentium® III processors are based on the battery optimized processor speed implemented by Intel's® SpeedStep™ technology. Intel® SpeedStep™ technology lets the user customize the performance level on notebooks. When the notebook computer is connected to the AC outlet, the processor runs at the highest frequency. When powered by a battery, the processor drops to a lower frequency and voltage, conserving battery life. At Transmeta's™ request we turned the brightness level of the active matrix displays to the lowest setting to level set these units. eTesting Labs tested the systems using Ziff Davis Media's BatteryMark and Winbench 99 Version 1.1 CPUmark 99.

BatteryMark 4.01 measures battery life on notebook computers running Windows 95, Windows 98, Windows NT 4.0, or Windows 2000. CPUmark 99 measures the speed of a PC's processor subsystem, including the CPU, internal cache (both level one and level two), external cache, and system RAM.

The NEC Versa DayLite performed best in our BatteryMark tests, returning Life Run results of 6 hours and 45 minutes, while the Dell Latitude L400 had the lowest BatteryMark score of 1 hour and 50 minutes. The Pentium III processor (running at 500MHz while on battery power), in the ThinkPad X20 and the Latitude L400, outscored both notebooks configured with the Crusoe processor, both running at 600 MHz, by nearly 20%. However, the much longer battery life of the notebooks with the Crusoe processor weighs strongly in its favor. The battery in the IBM i Series 1124, running at half the processor speed of the UltraLite and DayLite, had 12% less battery life than the UltraLite, and 33% less battery life than the DayLite.

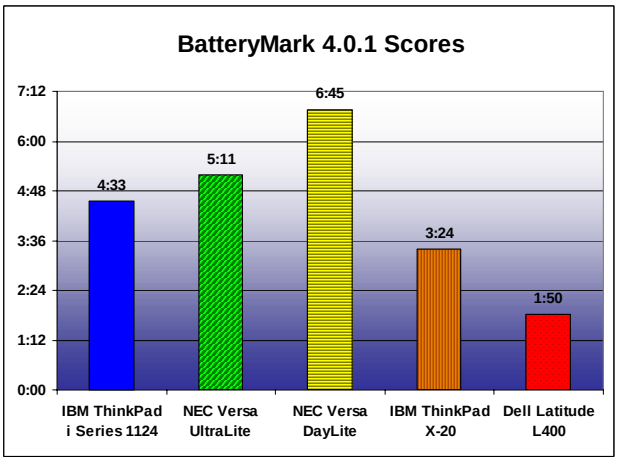

Figure 1: The NEC Versa DayLite's battery life was 33% better than the ThinkPad 1124.

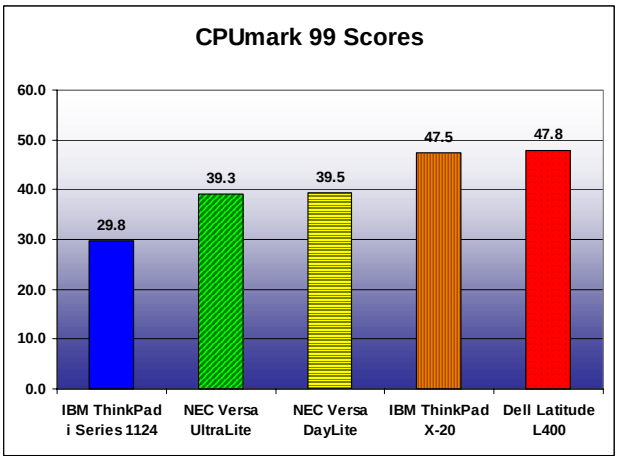

Figure 2: The NEC Versa notebooks performed 12% better than the i Series 1124, but 18% slower than the X-20 and L400.

Testing methodology

Test System Configuration

Transmeta™ Corporation commissioned eTesting Labs to perform competitive benchmark tests on five notebook computers. After we received the laptops, we formatted all hard drives, installed Windows 2000 SP1, and turned the brightness level of the active matrix displays to the lowest setting to level set these units. We made no changes to the BIOS. The Intel® SpeedStep™ setting was set to "Automatic" in the BIOS' of the IBM and Dell systems when we received them and we left that setting unchanged. We installed WinBench 99 Version 1.1 and BatteryMark 4.0.1 on each laptop. At Transmeta's™ request we performed all runs on battery power.

BatteryMark 4.0.1

BatteryMark measures a notebook computer's battery life and workload potential by exercising three different 32-bit software workload engines--one each for processor, disk, and graphics tasks. BatteryMark mixes these workloads together and adds periodic think times, or breaks, that reflect the way users pause while working. It then returns a score, in hours and minutes, that is a straightforward reporting of how long the notebook's battery took to run the life test. Larger scores mean the battery lasted longer.

The conditioning phase and a life test make up a complete BatteryMark test run. BatteryMark's conditioning phase drains the battery completely and rapidly two or more times, as preparation for the life test. This drain-and-recharge cycle ensures the battery is returning consistent power levels, which is a necessity before you start a life test. Conditioning the battery eliminates any battery memory effects on test results. (Conditioning doesn't harm computer batteries that don't ordinarily develop memory effects.) The result of consecutive conditioning runs also tells you whether the battery is returning a consistent amount of power. When the difference between two consecutive conditioning run times is 5% or less, BatteryMark considers the conditioning phase complete and recommends running the life test. For an inconsistently charged battery, BatteryMark recommends more conditioning runs. From the BatteryMark Status window, you can override BatteryMark's recommendation, if you wish, and choose to run the life test anyway.

Depending on the battery's initial power state, you can expect to perform two to three conditioning runs.

CPUmark 99

CPUmark 99 measures the speed of a PC's processor subsystem, including the CPU, internal cache (both level one and level two), external cache, and system RAM. CPUmark 99 is a synthetic benchmark based upon profiling real applications. The overall CPUmark 99 result is a unitless score in which larger numbers indicate better performance. eTesting Labs retired CPUmark 99 in July of 2000 (see http://www.zdnet.com/etestinglabs/stories/bi/0,8829,2599709,00.html for more details.) We ran this test at Transmeta's™ request.

Test Methodology

1. After building Windows 2000 Service Pack 1 standard test images, completely drain all batteries.
2. Fully re-charge all batteries.
3. Defragment hard disks.
4. Unplug test systems from AC Power.
5. Reboot.
6. Run CPUmark 99.
7. Completely drain all batteries.
8. Fully re-charge batteries.
9. Defragment hard disks.
10. Reboot.
11. Run BatteryMark 4.0.1 Conditioning Run.
12. Repeat steps 2 through 11.

a. If the two CPUmark 99 scores are within 5% of each other discontinue running CPUmark 99. Otherwise, perform additional runs until there is less than 5% variance.
b. If the two BatteryMark Conditioning Runs are within 5% of each other, move to step 13. Otherwise, perform additional Conditioning runs until there is less than 5% variance.

13. Completely drain batteries.
14. Fully re-charge batteries.
15. Defragment hard disks.
16. Reboot.
17. Run BatteryMark 4.0.1 Life Run.
18. Repeat steps 13 through 17 until two Life Runs fall within 5% variance.

Test results

The five notebooks we tested were similar in design and features, ranging from the 3.1 lb IBM X20 to the 3.4 lb Dell Latitude. All had similar dimensions, approximately 1"x7"x10". All but the Versa DayLite, which had a backlit display, had active matrix displays (thin film transistor), and all but the ThinkPad 1124 had 4MB ATI Rage Mobility-M graphics adapters. The ThinkPad 1124 had a Lynx EM+.

Figures 3 and 4 detail the results of our CPUmark 99 and BatteryMark 4.0.1 testing.

Notebook	DC Processor Speed	CPUmark 99 Run 1	CPUmark 99 Run 2
IBM i Series ThinkPad 1124	PIII - 300 MHz	29.8	29.8
NEC Versa UltraLite	TM - 600 MHz	39.5	39.2
NEC Versa DayLite	TM - 600 MHz	39.4	39.8
IBM x Series ThinkPad X-20	PIII - 500 MHz	47.5	47.5
Dell Latitude L400	PIII - 500 MHz	47.7	47.8

Figure 3: On CPUmark 99 the NEC Versa notebooks performed 12% better than the i Series 1124, but 18% slower than the X20 and L400.

Notebook	Life Run 1	Life Run 2
IBM i Series ThinkPad 1124	4:33	4:33
NEC Versa UltraLite	5:11	5:11
NEC Versa DayLite	6:45	6:45
IBM x Series ThinkPad X-20	3:21	3:24
Dell Latitude L400	1:50	1:50

Figure 4: The NEC Versa DayLite's battery life was 33% better than the ThinkPad 1124's and 73% better than the Latitude L400's.

Appendix

A. Test System Disclosures

NEC Versa DayLite	
Processor/Speed/Number Of	Transmeta™ Crusoe™ / 600 MHZ / 1
System RAM/Type/# of Slots	128 MB
Motherboard Manufacturer	ALI
Motherboard Chipset/Model	ALI M5229
Main Bus Type	PCI
L2 Cache	256 KB
BIOS	PhoenixBIOS 303A1700
HD Model # / Size	HITACHI DK23BA-20 / 18.6 GB
HD Controller	ALI M5229 PCI BUS MASTER IDE CONTROLLER
HD Buffer Size	2048 KB
Graphics Adapter	ATI RAGE MOBILITY-M
Graphics Driver & Version	ATI2DRAB.DLL / 5.00.2195.4038
Graphics Memory (MB type)	4 MB
Graphics Chip Type	ATI RAGE MOBILITY P/M
Video Resolution Assigned	800 x 600
Color Depth Assigned	16 BBP
Refresh Rate	60 HZ
DAC TYPE	INTERNAL
Sound Board	ESS SOLO-1
NIC (Driver)	INTEL PRO/100+ MINIPCI
CD-ROM Type & Speed	TEAC CD-210PU USB
DVD Type & Speed	N/A
OEM OS	Windows 2000 (SP1 RC1.1)
USB Chipset	1.0
# PCI Slots	N/A
Extra Hardware (ie Zip drive)	EXTERNAL FLOPPY, XIRCOM MPCI MODEM 56

Figure 5: NEC Versa DayLite system disclosure.

NEC Versa UltraLite	
Processor/Speed/Number Of	Transmeta™ Crusoe™ / 600 MHZ / 1
System RAM/Type/# of Slots	128MB
Motherboard Manufacturer	ALI
Motherboard Chipset/Model	ALI M5229
Main Bus Type	PCI
L2 Cache	256 KB
BIOS	PHOENIX 4.0 RELEASE 6.0.5
HD Model # / Size	HITACHI DK23BA-20 / 18.6GB
HD Controller	ALI M5229
HD Buffer Size	2048 KB
Graphics Adapter	ATI RAGE MOBILITY-M
Graphics Driver & Version	ATI2MPAB.SYS V 5.00.2195.4038
Graphics Memory (MB type)	4MB
Graphics Chip Type	ATI
Video Resolution Assigned	1024X768
Color Depth Assigned	16 BIT
Refresh Rate	60 HZ
DAC TYPE	INTERNAL
Sound Board	ESS SOLO-1 PCI
NIC (Driver)	INTEL PRO/100+ (E100BNT5.SYS V4.03.25.0000)
CD-ROM Type & Speed	TEAC CD-210PU USB
DVD Type & Speed	N/A N/A
OEM OS	Windows 2000 (SP1 RC 1.1)
USB Chipset	ALI M5229
# PCI Slots	N/A
Extra Hardware (eg Zip drive)	N/A

Figure 6: NEC Versa UltraLite system disclosure.

IBM i Series 1124	
Processor/Speed/Number Of	Intel® Pentium® III / 500(AC)/300(DC) MHZ /1
System RAM/Type/Slots	64 MB / PC100
Motherboard Manufacturer	INTEL
Motherboard Chipset/Model	82440MX
Main Bus Type	PCI
L2 Cache	256 KB
BIOS	PHOENIX BIOS 4.0 RELEASE 6.0
HD Model # / Size	IBM DJSA-220 / 5.0 GB
HD Controller	INTEL 82440 MX
HD Buffer Size	2048 KB
Graphics Adapter	SILICON MOTION LYNX EM+
Graphics Driver & Version	N/A
Graphics Memory (MB type)	4 MB
Graphics Chip Type	LynxEM+
Video Resolution Assigned	800 x 600
Color Depth Assigned	16 BBP
Refresh Rate	60 HZ
DAC TYPE	INTERNAL
Sound Board	CRYSTAL SOUNDFUSION (CS 4281 WDM)
NIC (Driver)	N/A
CD-ROM Type & Speed	N/A
DVD Type & Speed	SHARED WITH OTHER IBM MATSHITA
OEM OS	Windows 2000
USB Chipset	1.0
# PCI Slots	N/A
Extra Hardware (eg Zip drive)	LUCENT WIN MODEM

Figure 7: IBM i Series 1124 system disclosure.

IBM x Series X20	
Processor/Speed/Number Of	Intel® Pentium® III / 600(AC)/500(DC) MHZ / 1
System RAM/Type/# of Slots	128 MB / PC100
Motherboard Manufacturer	INTEL
Motherboard Chipset/Model	82443 BX
Main Bus Type	PCI
L2 Cache	256 KB
BIOS	PHOENIX BIOS 4.0 RELEASE 6.0
HD Model # / Size	N/A / 9.30 GB
HD Controller	INTEL 82371AB/EB
HD Buffer Size	2048 KB
Graphics Adapter	RAGE MOBILITY-M1
Graphics Driver & Version	ATI2DRAB.DRV / 4.12.2173
Graphics Memory (MB type)	4 MB
Graphics Chip Type	MACH-64
Video Resolution Assigned	800 x 600
Color Depth Assigned	16 BBP
Refresh Rate	60 HZ
DAC TYPE	INTERNAL
Sound Board	CRYSTAL SOUNDFUSION (CS4281 WDM)
NIC (Driver)	3COM 10/100 MINI PCI ETHERNET ADAPTER
CD-ROM Type & Speed	MATSHITA DVD-ROM SR-8175
DVD Type & Speed	N/A
OEM OS	Windows Me
USB Chipset	1.0
# PCI Slots	N/A
Extra Hardware (eg Zip drive)	3COM MINI PCI 56K MODEM

Figure 8: IBM x Series X20 system disclosure.

Dell Latitude L400	
Processor/Speed/Number Of	Intel® Pentium® III / 700(AC)/500(DC) MHZ 1
System RAM/Type/# of Slots	128MB
Motherboard Manufacturer	INTEL
Motherboard Chipset/Model	82371AB/EB
Main Bus Type	PCI
L2 Cache	N/A
BIOS	PHOENIX 4.0 RELEASE 6.0
HD Model # / Size	IBM-DJSA-210 / 10GB
HD Controller	INTEL 82371AB/EB
HD Buffer Size	512 KB
Graphics Adapter	ATI RAGE MOBILITY-M AGP2X
Graphics Driver & Version	ATI2MPAB.SYS VER. 5.0.2195.4043
Graphics Memory (MB type)	4MB
Graphics Chip Type	ATI
Video Resolution Assigned	1024X768
Color Depth Assigned	16 BIT
Refresh Rate	60 HZ
DAC TYPE	INTERNAL
Sound Board	CRYSTAL SOUND FUSION CS4281
NIC (Driver)	3COM 3C905C-TX (EL90XBC5.SYS VER. 1.80.00.0000)
CD-ROM Type & Speed	TEAC CD-224E
DVD Type & Speed	N/A
OEM OS	WINDOWS 2000 5.00.2195 SP1
USB Chipset	INTEL 82371AB/EB
# PCI Slots	N/A
Extra Hardware (eg Zip drive)	N/A

Figure 9: Dell Latitude L400 system disclosure.

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