インテルのグリーンITへの取り組みと JP1連携

インテル株式会社
事業開発本部
下野　文久

インテルのエコ･テクノロジーへの取り組み

持続可能な
製造体制の構築

電力効率に
優れた性能

環境に配慮した
製品設計

ポリシーと業界
各社との連携

インテルのエコ･テクノロジーへの取り組み

インテルの環境に対する活動の歴史

先駆的取り組み

透明性、情報開示

企業全体での継続的改善を推進

1994
環境レポートの公表

1996
エネルギーレポートの公表

1998
最初の地球規模での産業横断的気候変動も区報の設定

2000
気候変動への影響を公表

業界で PFC ガス削減を主導:
世界で最初に自主的な CHGの削減に合意

2003
世界的な省エネルギー目標の設定

2006
米国環境保護庁　クライメート･リダーズに参加:　地球規模での気候変動の影響目標の設定

2007
「グリーン」ファブ 32 稼動

2008
米国最大のグリーン電力購入企業に

インテルの環境に対する取り組みの歴史

出展: Intel 2006 Corporate Social Responsibility Report.

透明な情報開示

Quarterly EHS Indicators - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Favorites

Address http://www.intel.com/intel/other/ehs/update.htm

Performance Indicators

	2002	2003	2004	2005	2006	2007
Intel Recordable Injury/Illness Case Rate (per 200K hours)	0.32	0.30	0.34	0.44	0.42	0.45
VOC Emissions (Tons)	221	202	232	212	254	247
HAP Emissions (Tons)	25	25	31	26	23	21
GWG from PFC (Million Metric Tons - Carbon Equiv.)	0.52	0.37	0.30	0.28	0.25	0.22
GWG from Energy (Million Metric Tons - Carbon Equiv.)	0.59	0.59	0.64	0.68	0.76	0.74
Water Use: (Millions of Gallons)	5,820	6,100	6,000	6,760	7,650	7,517
Energy Use: All Sources (Million kWh)	4,580	4,680	5,020	5,290	5,790	5,697
Solid Waste Generated (Tons)	52,900	43,300	47,800	54,600	61,000	58,750
Chemical Waste Generated (Tons)	21,700	20,100	20,300	27,400	30,000	23,260
Solid Waste Recycled (Percent)	67%	74%	74%	75%	74%	80%
Chemical Waste Recycled (Percent)	56%	67%	64%	58%	68%	87%*

Key: VOC = Volatile Organic Compounds, HAP = Hazardous Air Pollutants, GWG = Global Warming Gases

*Recycling now includes energy recovery from fuel blending

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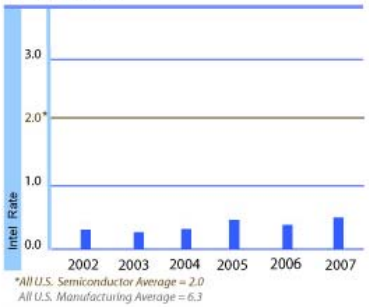
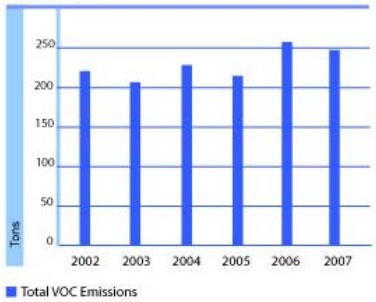
INTEL RECORDABLE INJURY/ILLNESS CASE RATES

Per 100 Employees



VOC EMISSIONS

Worldwide



Done Trusted sites

出典: インテル コーポレーション http://www.intel.com/intel/other/ehs/update.htm （英語）

事業における環境負荷の低減

大気汚染

温暖化ガス

エネルギー

水

化学物質

ロジスティクス
&
輸送

排水

化学廃棄物

一般廃棄物

事業における環境負荷の低減

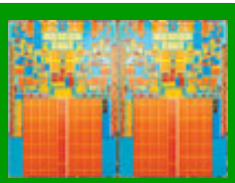
インテルは秀でたリーダーシップで、カリフォルニア州　クリーン・エアー賞を受賞

インテルはCHGの排出を製造拠点ごとに30%削減することを表明

インテル・アイルランドはIS393 エネルギー管理システム認証を取得

インテル・オコチーロ支社は、米国環境保護庁水資源有効利用賞を受賞

インテル最新の45nmプロセッサーは、鉛*およびハロゲン**を不使用



インテルはファブおよび社屋で LEED 認証を推進

包装の簡素化による16 – 40%の発送回数および燃料の削減

300万ガロンを上回る水資源を特別な回収装置で再利量

インテル、レギュレーターズ・アンド・ネイバーズは、省資源化およびリサイクル活動を推進

一般廃棄物および家庭でのリサイクル活動による廃棄電子機器の削減

* 45nm product is manufactured on a lead-free process. Lead is below 1000 PPM per EU RoHS directive (2002/95/EC, Annex A). Some EU RoHS exemptions for lead may apply to other components used in the product package

**45nm Applies only to halogenated flame retardants & PVC in components. Halogens are below 900 PPM bromine & 900 PPM chlorine.

インテルは持続的エネルギーのリーダー

インテルは米国環境保護庁から、グリーン・パワー・リーダーシップ賞を受賞:

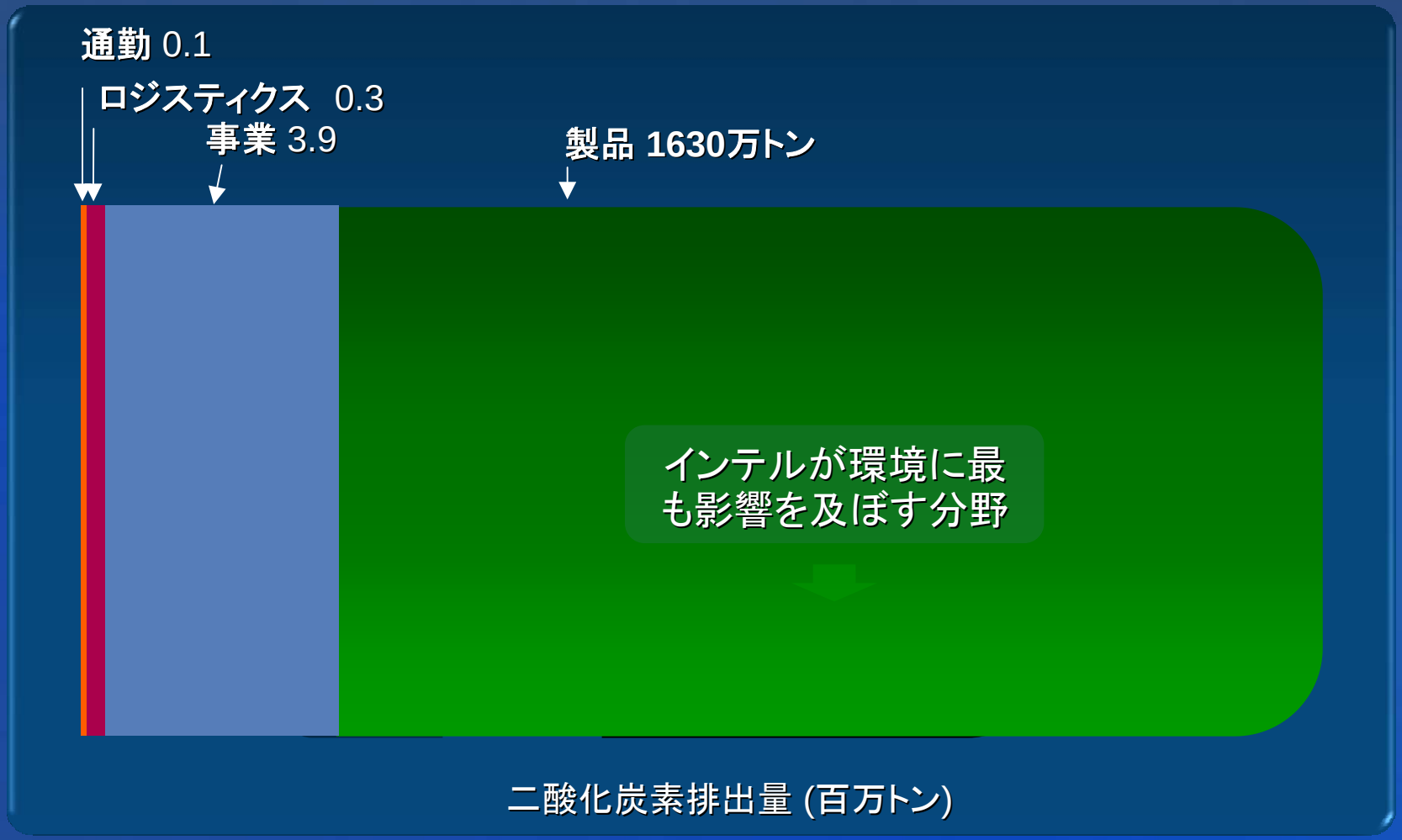
- インテルは米国の企業として持続的エネルギーの最大の購入者であり、グリーン電力パートナー・リストの最上位にランクされている
- インテルが購入している電力の約47%は、風力発電や太陽光発電等の持続的エネルギーを源としている

各地のインテルでの太陽光発電の設置開始と迅速な拡大:

- インド、バンガロール – 太陽光集熱器により年間 7万キロワットを節約 (全体の2%の電力に相当).
- 米国、オレゴン – 100Kw の太陽光発電装置を本年中にジョーンズファーム支社に設置
- 米国、ニュー・メキシコ - データ・センターでの太陽光発電の利点を示すデモ・システムを本年中に設営

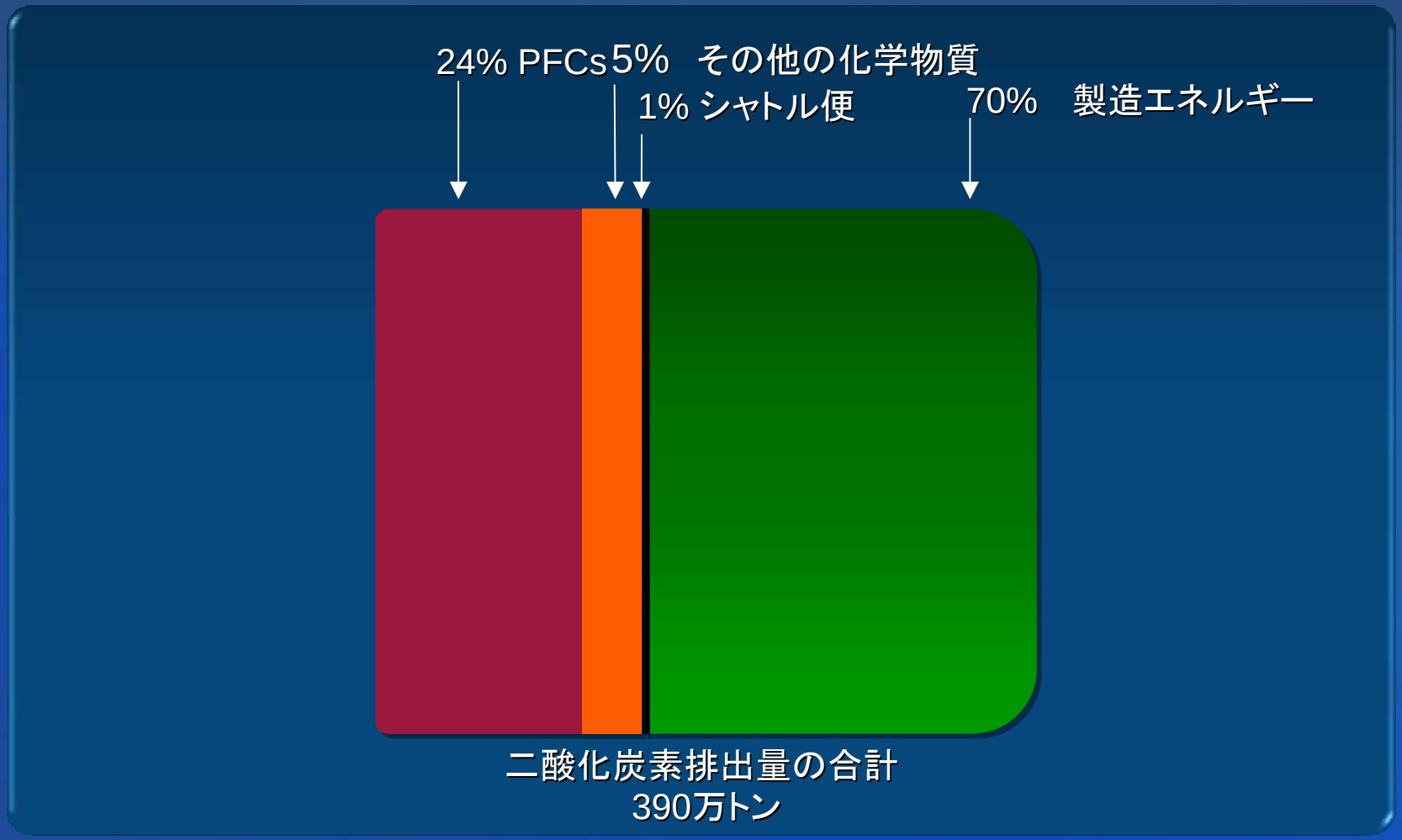
事業領域および製品における二酸化炭素の排出

(毎年出荷される製品が及ぼす影響に基づく)



出展: Internal data, combined with World Resources Institute protocol for converting to CO2 impact.
Other chemicals includes N2O, fluorinerts, refrigerants, and CO2 generated from VOCs.
Note: Supply Chain not included.

2006年　インテルの事業領域における二酸化炭素の排出



出展: Internal data, combined with World Resources Institute protocol for converting to CO2 impact.
Other chemicals includes N2O, fluorinerts, refrigerants, and CO2 generated from VOCs.
Note: Supply Chain not included.

インテルのエコ･テクノロジーへの取り組み

電力効率に優れた性能

持続可能な
製造体制の構築

電力効率に
優れた性能

環境に配慮した
製品設計

ポリシーと業界
各社との連携

インテルの「正しい方向」への転換：2000億ドルのエネルギーコストの削減

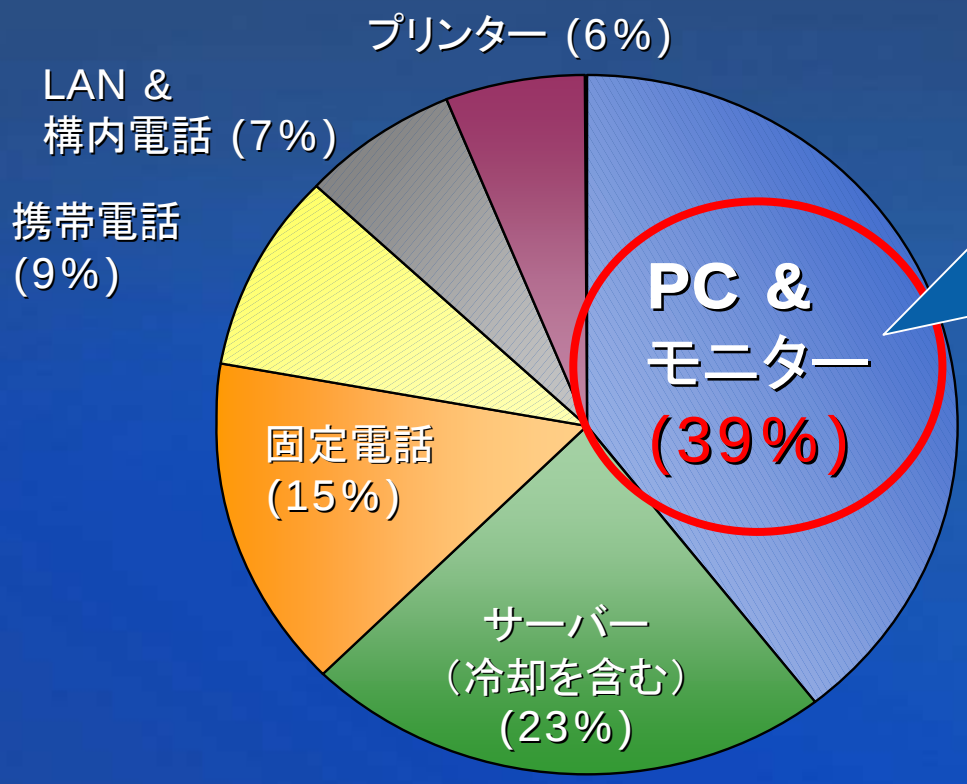
地球規模での2% のCO2 排出量 = 情報通信 (ICT)
マイクロプロセッサーの位置づけは？　エネルギーの削減に貢献しているか？

2006年発表: インテル Core マイクロアーキテクチャー
20 テラ（兆）ワット時の消費電力削減　=
2000億ドルのエネルギー・コストの削減*

*Estimated, not actual. Source: Intel Blog “The Increasing Value of Energy Efficiency” Sept 23, 2008.
http://blogs.intel.com/csr/2008/09/the_increasing_value_of_energy.php
All dates, product descriptions, availability and plans are forecasts and subject to change without notice.

クライアントPCのエコ対策、後回しになっていませんか?

企業ITにおける、二酸化炭素排出比率



「データセンターは、
様々な機器が
集約されているため、
大きく注目されている。」

*「しかしながら、
最も効果が高い分野は、
実はオフィスの机の上と
クライアント機器である。」*

企業ITにおいて、省電力PCの導入が重要

出典: Gartner Inc. “Tera-Architectures A Convergence of New Technologies” by Martin Reynolds（2007年7月26日）

最近の新しい話題

- グリーンITと言われているけど、IT部門として何をすれば?
- PCの運用管理って有効なの?
- 保守・運用のアウトソースを検討しろと言われたのですが?

新世代ビジネス・クライアントPC

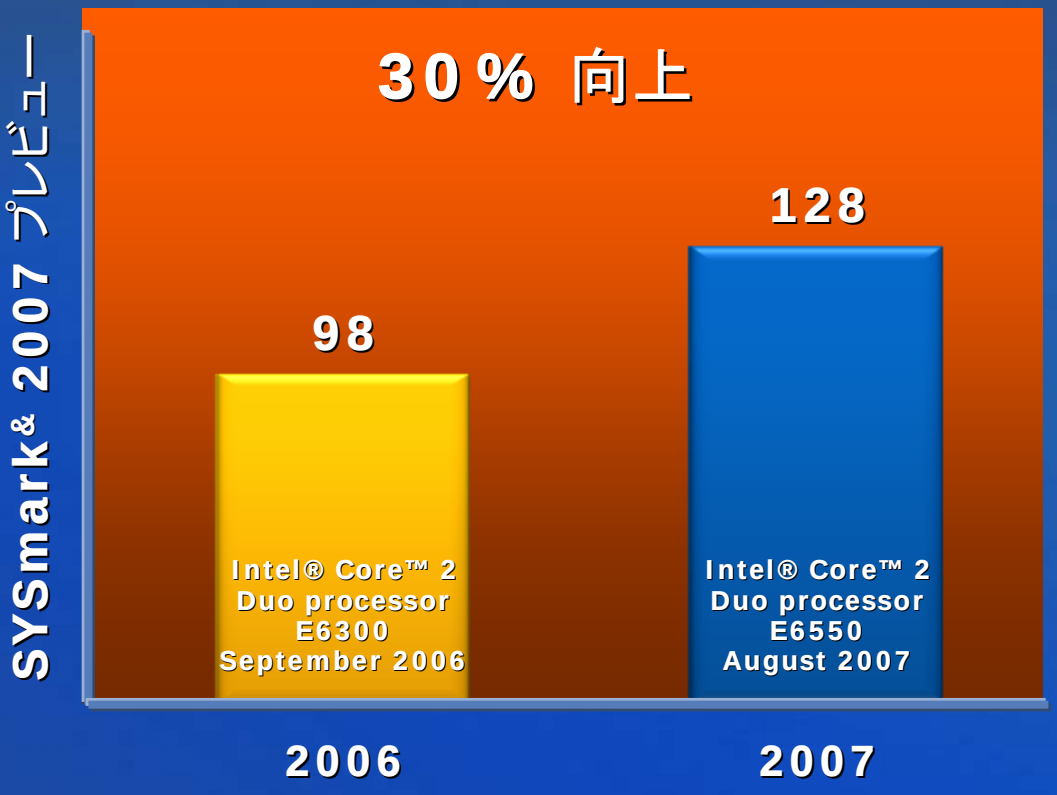
- 省電力かつ高性能
- 優れた運用・管理機能
- 強化されたセキュリティー機能

<デスクトップPC向け>
vPro™ テクノロジー
インテル® Core™2
プロセッサー

<ノートブックPC向け>
vPro™ テクノロジー
インテル® Centrino®

管理することでもエコを実現

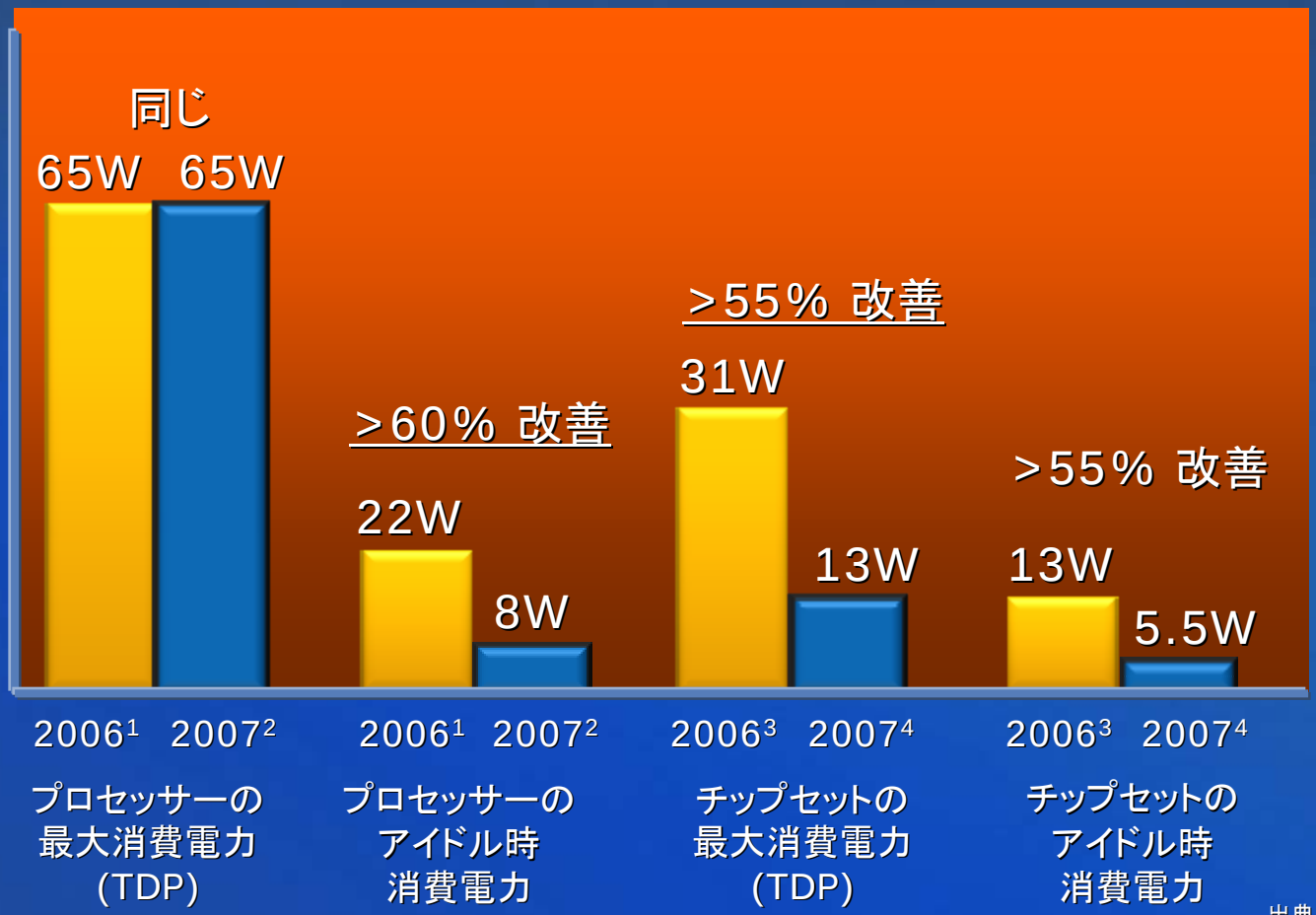
2007年 インテル® vPro™ テクノロジー
パフォーマンスは大幅に向上…



出典：インテル。システム構成とその他の重要な情報についてはバックアップを参照

インテル製品は、予告なく仕様が変更される場合があります。
本資料に記載されているすべての製品、日付、および数値は、
現在の予想に基づくものです。

インテル® vPro™ テクノロジー
消費電力を大きく削減

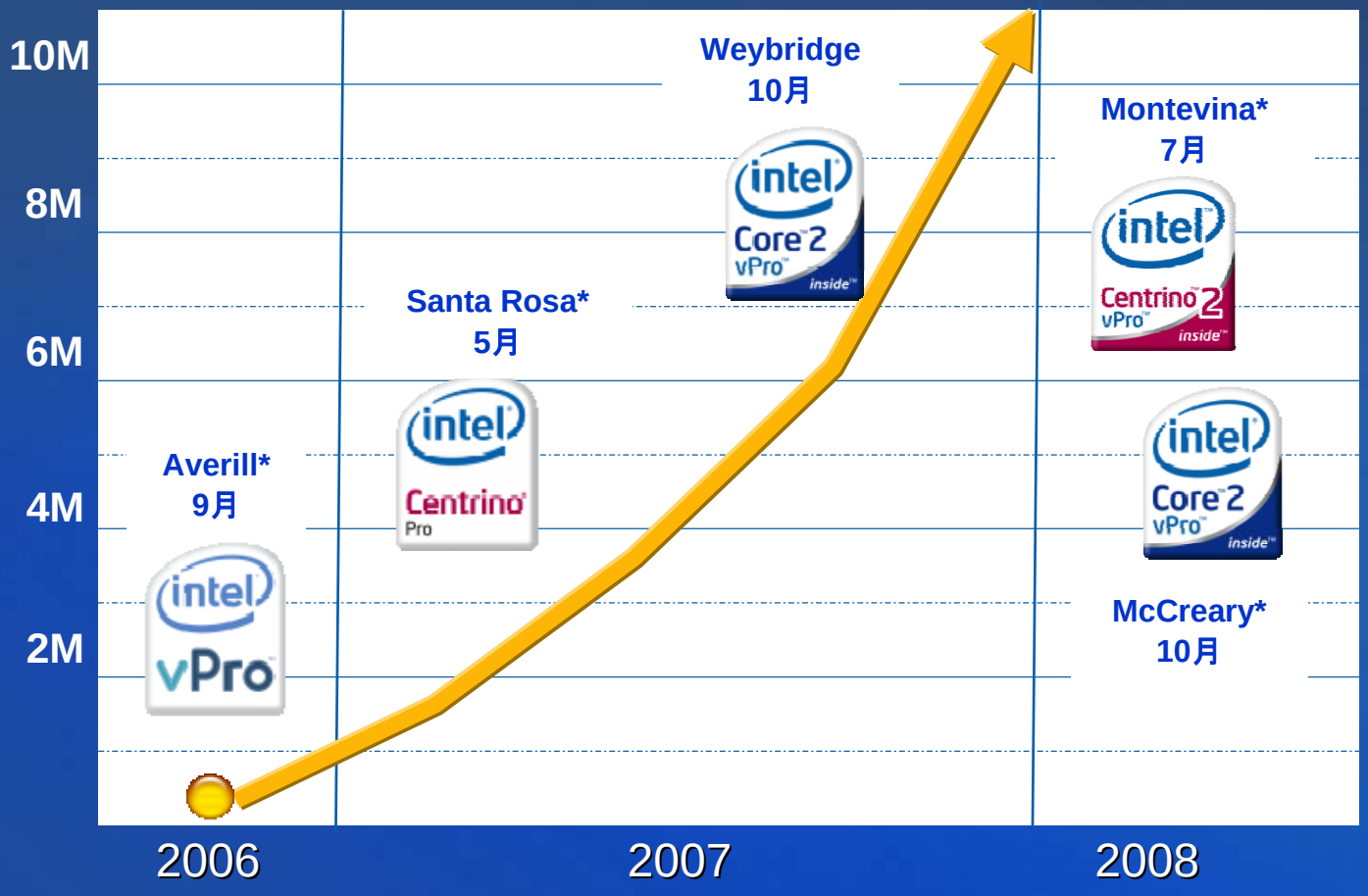


出典：インテル、公開済み仕様

インテル製品は、予告なく仕様が変更される場合があります。本資料に記載されているすべての製品、日付、および数値は、現在の予想に基づくものです。

1. インテル® Core 2 Duoプロセッサー E6xxxシーケンス、2006年9月
2. インテル® Core 2 Duo プロセッサー E6x50シーケンス、2007年8月
3. インテル® Q965 ExpressチップセットとICH8-DO2006年9月
4. インテル® Q35 ExpressチップセットとICH9-DO、2007年8月

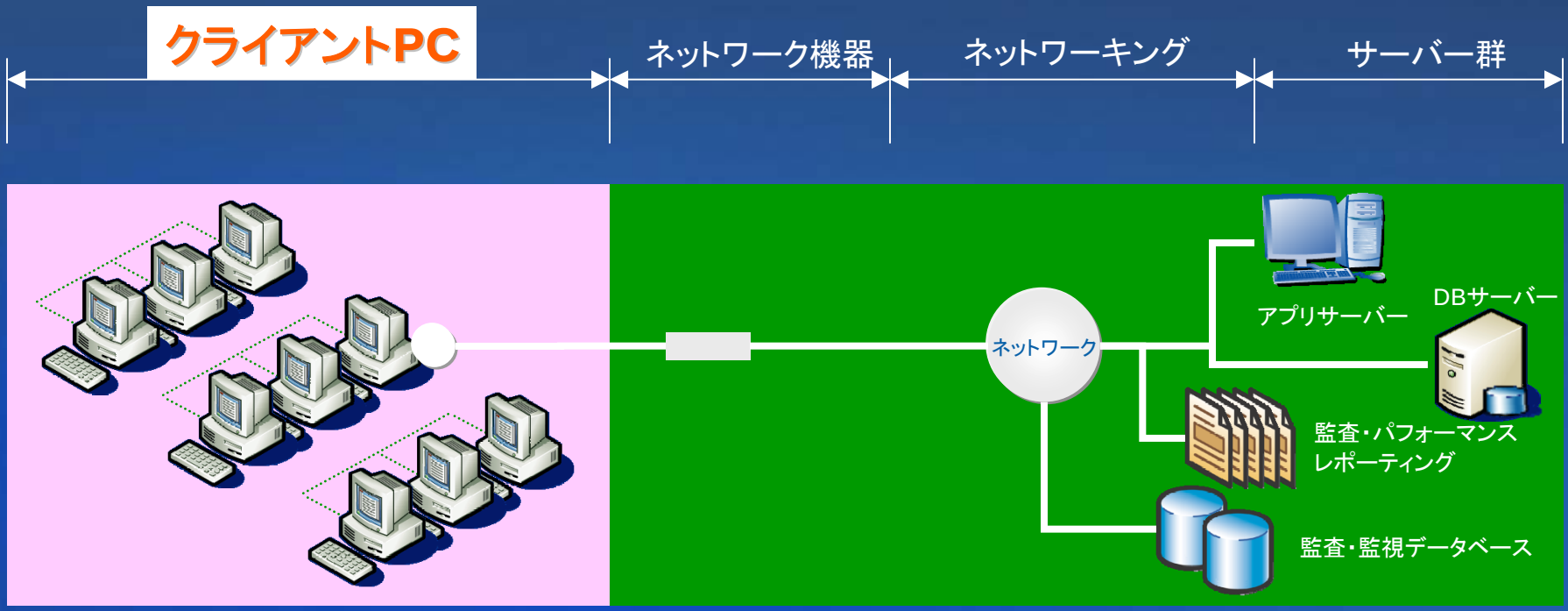
インテル® vPro™ テクノロジーの市場状況



* 開発コード名

- *累計1400万台出荷（2008年5月末時点）*
- *350社以上が採用（FT500社のうち50社以上が採用）*
- *9社のITサービスプロバイダーが販促中*
- *世界30以上の対応SWが製品化済み*

頭の痛いIT環境における問題箇所

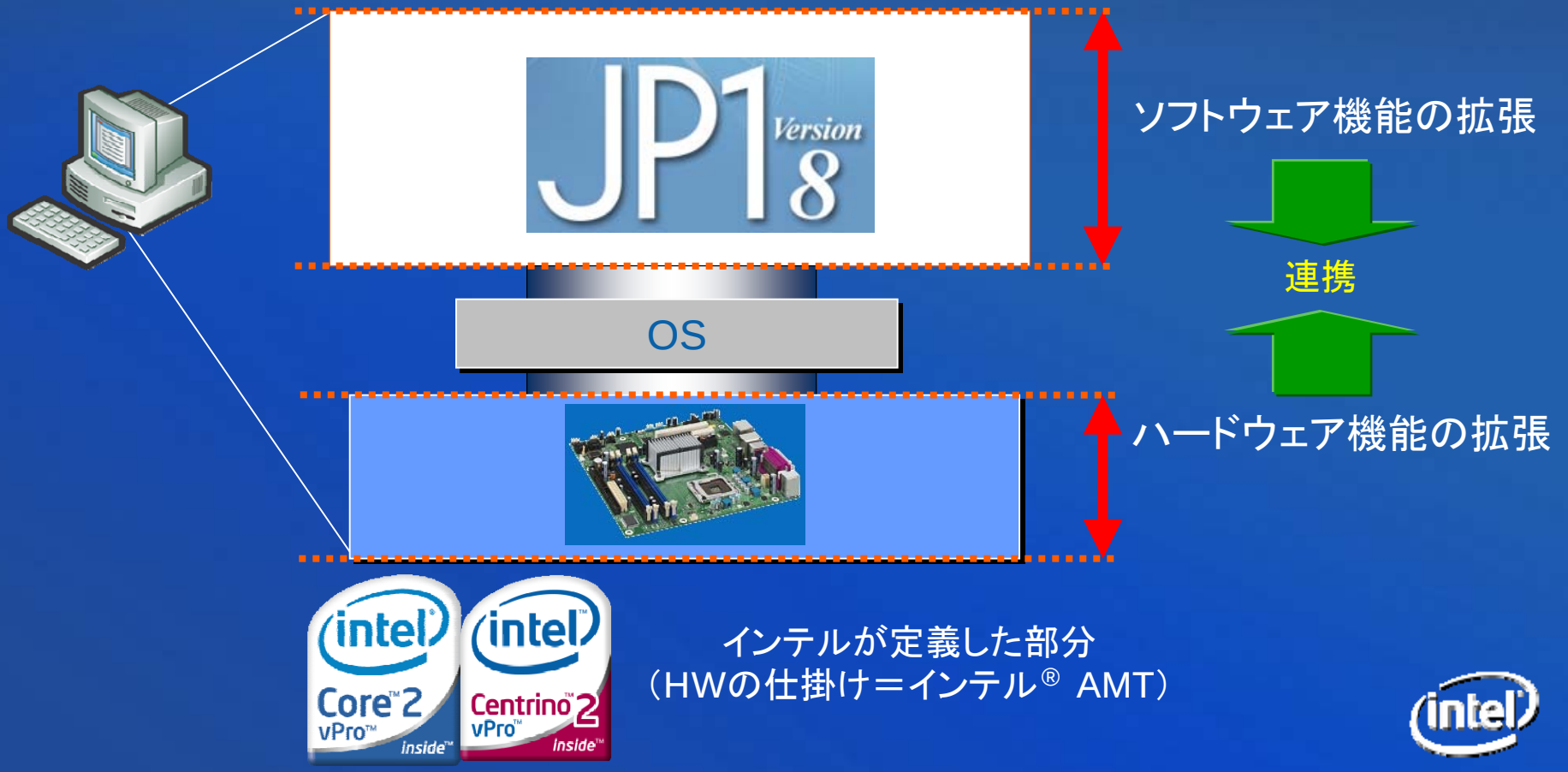


- 残されたセキュリティー・ホール!
- リモート管理に限界!

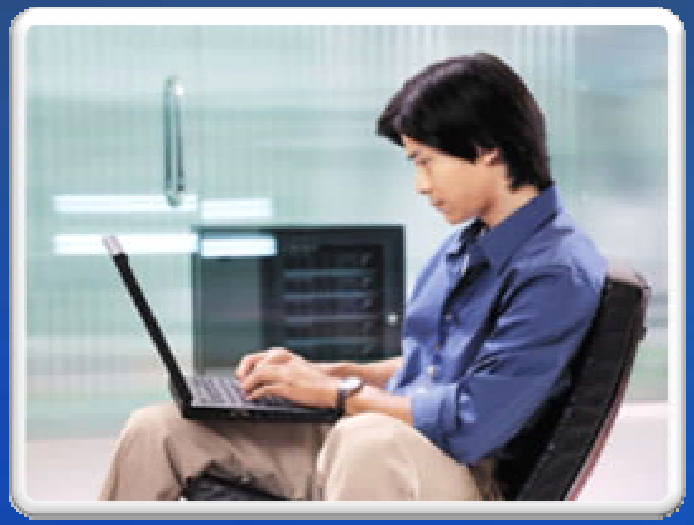
- 技術革新によりセキュリティー、管理性は大幅に向上
- スキルの高い技術者による運用管理

エコシステムによる価値最大化

- ハードウェア機能の拡張（by インテル）
- ソフトウェア機能の拡張（by 日立製作所様）



ちょっとしたエコアイデア



今すぐできることから始めてみませんか！

コンピュータ環境と電力消費の比較

運用管理
未導入

インテル® Pentium® D
プロセッサー 945

CRT及び液晶モニター

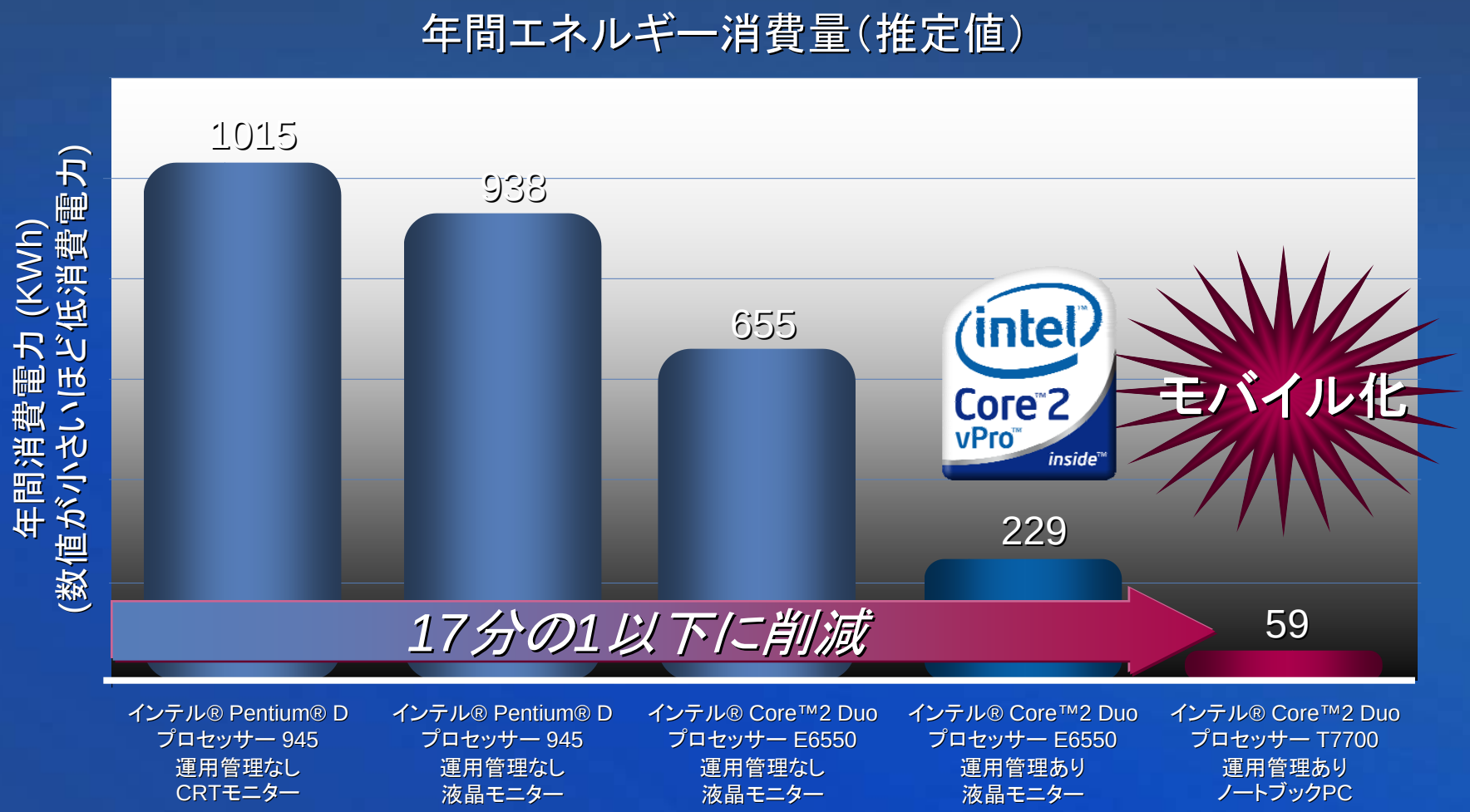
運用管理
未導入から導入へ

インテル® Core™2 Duo
プロセッサー E6550

運用管理
導入

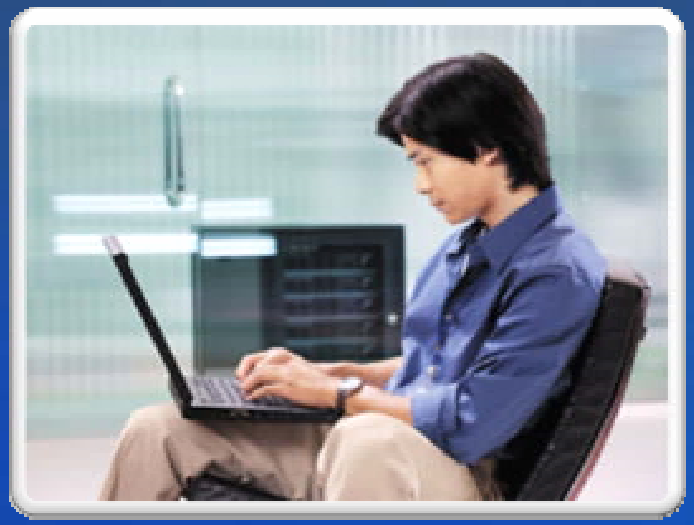
インテル® Core™2 Duo
プロセッサーT7700

削減可能なエネルギー消費量



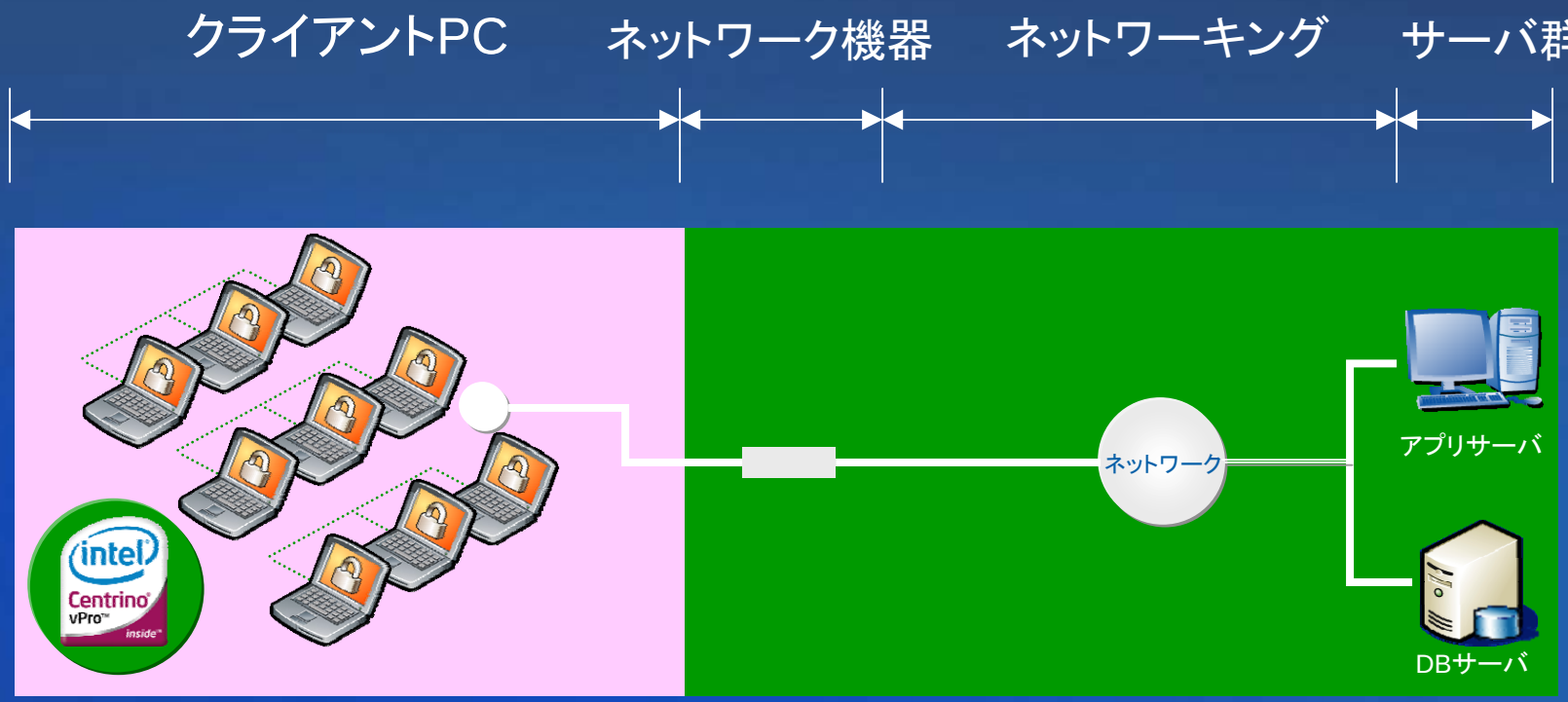
システム構成環境は補足資料を参照

今すぐできる4つのエコアイデア



1.モニターの変更
2.エコPCへの買い替え
3.運用管理
4.モバイル化

プラットフォームを活用したIT環境の全体最適



- クライアント部分のインテリジェント化によりセキュリティ・管理性は大幅に向上
- 既存ネットワークインフラ、検疫ソリューション等との高い親和性
- 企業IT全体としてエコ対応を実現

クライアント選定の判断基準 (従来)

	従来
クライアントの位置付け	ビジネスツール
購買の決め手	(低)価格
購買責任	購買部門担当者
セキュリティー対策	ソフトウェア主導
運用管理コスト低減	請負事業者の努力

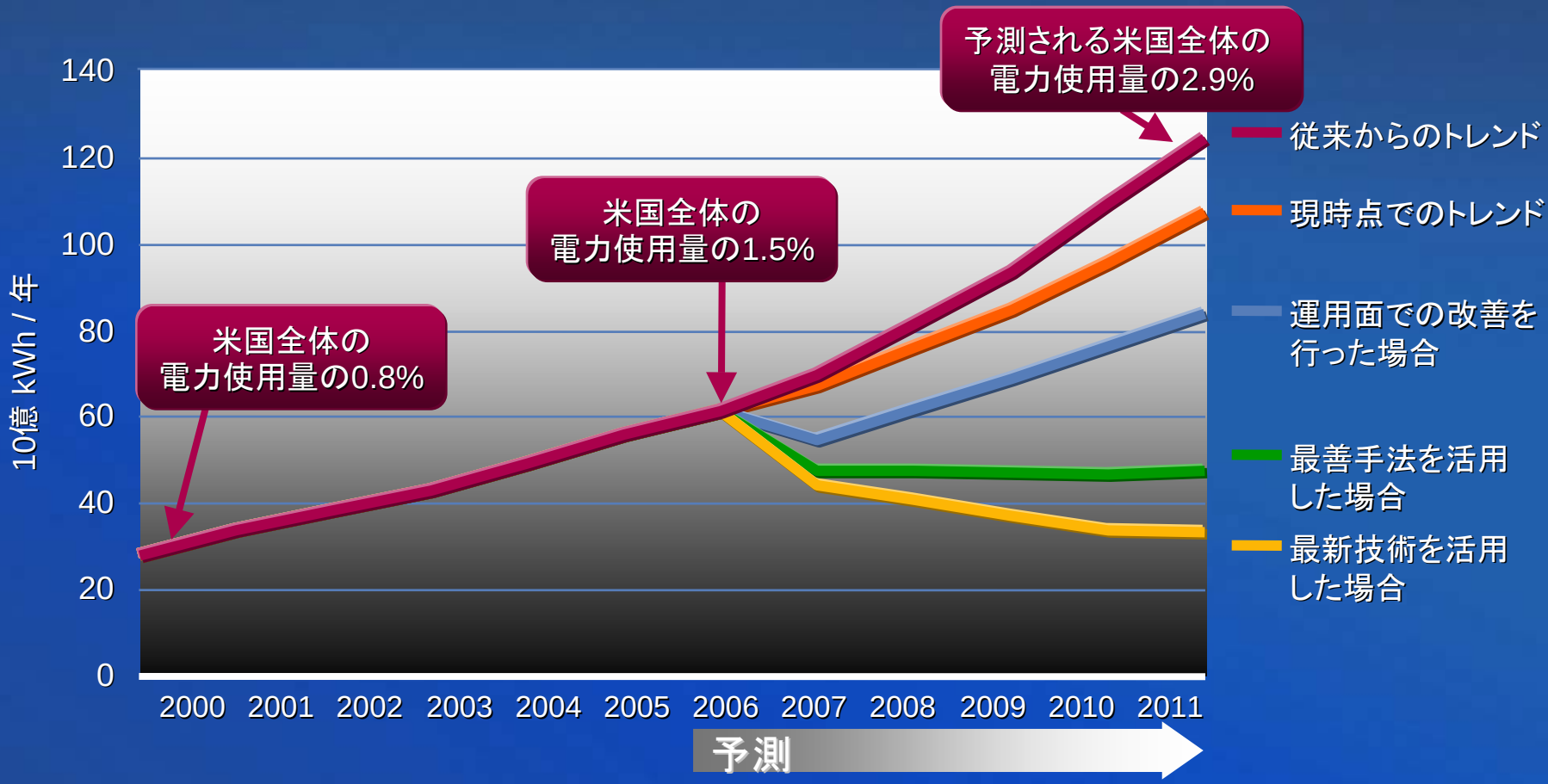
クライアント選定の判断基準 (今後)

～単純購買から戦略的購買へ～

	今後
クライアントの位置付け	ビジネスツール ITコンプライアンス、BPR、CSR
購買の決め手	エコ・性能/管理性/セキュリティー
購買責任	CxO、IT部門責任者
セキュリティー対策	ハードウェア／ソフトウェアの 最適な組み合わせ
運用管理コスト低減	経営判断

データセンターの効率化の機会

5つのシナリオに基づいたデータセンターのエネルギー消費量の予測



米国環境保護庁がアメリカ連邦議会に行った
「サーバーおよびデータセンターのエネルギー効率」に関するレポート（2007年8月2日）

インテルのエコ・テクノロジーへのアプローチ

ビジネス上の課題: 毎秒5億1千万 業務処理演算能力

2004年
- 5.1M bops
- 6 ラック
- 126台のサーバー
- 240 sq ft
- 48 kW

45nmプロセス技術に基づくクアッドコア インテル® Xeon® プロセッサー5400番台

2008年
- 5.1M bops
- 1 ラック
- 17枚のブレード
- 40 sq ft
- 6 kW

効果

フロア面積 約83% 削減

年間エネルギー・コスト 約87% 削減

エネルギー・コスト 約$53K 削減*

電力削減効果によりサーバー購入コストを約2年で回収

出典: SPECjbb2005に基づいた比較。bops = 秒当たりビジネスオペレーション数

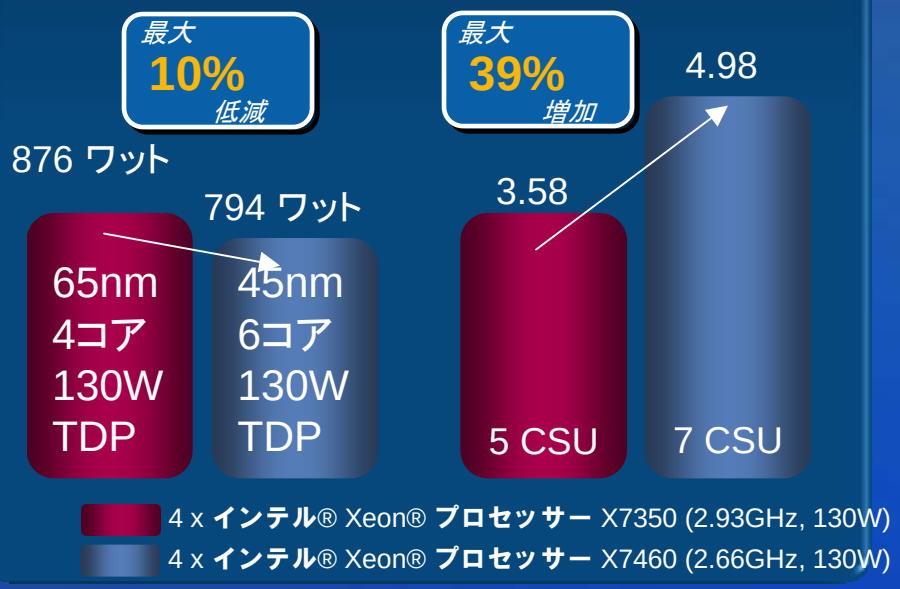
*Estimated Savings

Source: Intel January 16, 2008. Performance comparison using SPECjbb2005 bops (business operations per second) between (2004) 2 socket single core Intel Xeon processor (3.6GHz) and (2008) 2 socket Quad-Core Intel Xeon processor E5450 (3.0GHz, 80W, 1333MHz) measured 8/22/07. [1] Floor space based foot on sq ft reduction. [2] Energy costs based on total solution rack power. [3] Energy Savings based on an electric rate of $0.10/kWh assuming 33% average server load. [4] ROI is calculated based on cost of new servers ($6,264 per server pricing based on HP DL 380G5 (32GB RAM) as of Nov 17, 2007. (source www.hp.com) divided by energy savings per year. Actual performance results and savings may vary depending on configuration. See slide 49 for details.

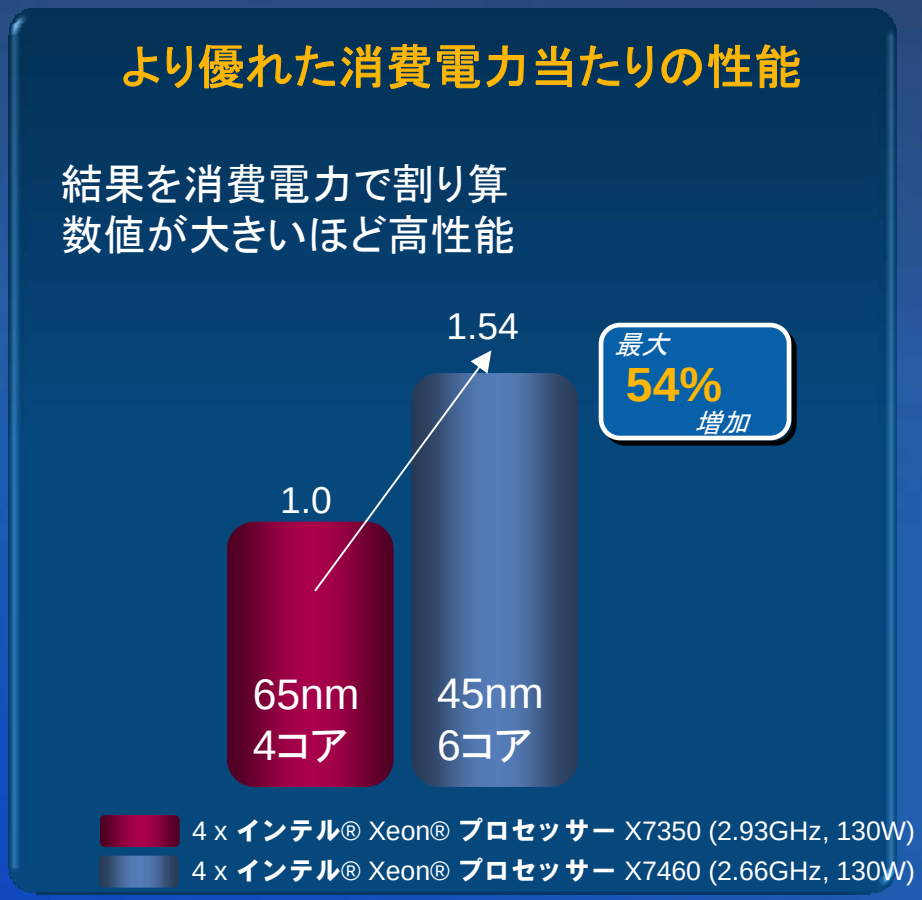
高いエネルギー効率の利点

VMware* ESX サーバー 3.5 – vConsolidate ワット当たりの性能

より低い消費電力で仮想化を実行



より優れた消費電力当たりの性能



統合化において、最大 54% のエネルギー効率の向上

「現実」のエネルギー効率: 1-2 ソケット上位の SPEC™ パワーの結果

Rank	Sponsor	SPECpower_ssj2008 overall ssj_ops/watt	Platform	Processors (2-socket)
1	NEC	1010	ECO CENTER	2x Intel® Xeon® L5420
2	HP	930	DL180 G5	2x Intel® Xeon® L5420
3	Inspur	910	NF290D2	2x Intel® Xeon® L5420
4	IBM	854	X3450	2x Intel® Xeon® E5462
5	HP	778	DL180 G5	2x Intel® Xeon® E5450
6	SGI	748	XE320	2x Intel® Xeon® E5472
7	Dell	744	PE 1950 III	2x Intel® Xeon® L5420
8	HP	734	DL160 G5	2x Intel® Xeon® L5420
9	HP	722	DL360 G5	2x Intel® Xeon® E5450
10	Dell	719	PE 2950 III	2x Intel® Xeon® E5440

The Primary Metric for SPECpower_ssj2008: overall ssj_ops/watt = Σ ssj_ops @ 11 pts / Σ avg watts @11 pts

出展: Public SPECpower results from http://www.spec.org/power_ssj2008/results/power_ssj2008.html as of October 15, 2008.

グリーンIT　アワード　2008
インテル® Xeon® プロセッサー

ITの省エネ部門：商務情報政策局長賞

Green IT AWARD 2008
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インテルのエコ･テクノロジーへの取り組み

環境に配慮した製品設計

持続可能な製造体制の構築

電力効率に優れた性能

環境に配慮した製品設計

ポリシーと業界各社との連携

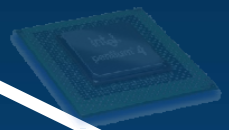
継続性への絶え間ない努力

インテルは Xeon からハロゲンを除去

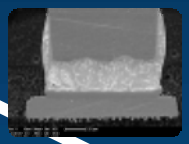
Suzanne Deffree, Electronic News, 9/8/2008

Following up on halogen-free promises, Intel Corp today expanded its 45-nm portfolio with the launch of its first four halogen-free Xeon processors. Intel in 2007 had stated it would begin removing halogen from its portfolio and took first steps to make good on that statement when it rolled out 16 45-nm processors at the January Consumer Electronics Show (CES) based on its hafnium-based high-k metal gate (Hi-k) formula.

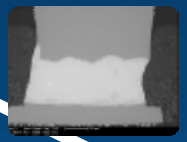
鉛不使用のリードフレームと BGA



90nm フリップチップ 鉛不使用 BGA とソケット



65nm 鉛不使用バンプ



45nm 鉛不使用フリップ・チップ・プロセス*

45nm HFR 不使用フリップチップ

評価中

- この次は?
- リサイクルの向上
- プロセス技術における科学物質 / 廃棄物の低減
- 省電力化

インテルは鉛除去に移行

Sumner Lemon, PC World, May 23, 2007

Chip giant will quit using lead in CPUs, starting with the Penryn line. Intel Corp. will stop using lead in its upcoming microprocessors, eliminating one of the most toxic components used in semiconductors from its product line.

- Reduction in Hazardous Substances

2003 2005 2007 2009 2011

* 45nm product is manufactured on a lead-free process. Lead is below 1000 PPM per EU RoHS directive (2002/95/EC, Annex A). Some EU RoHS exemptions for lead may apply to other components used in the product package

**45nm Applies only to halogenated flame retardants & PVC in components. Halogens are below 900 PPM bromine & 900 PPM chlorine.

インテルのエコ･テクノロジーへの取り組み

ポリシーと業界各社との連携

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the green grid™

Founding Companies

AMD APC DELL hp IBM intel

Microsoft Rackable systems SPRAYCOOL Sun microsystems vmware

- エネルギー効率に優れた
  データセンターを確立し推進する
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  - エネルギー効率に関する標準、プロセス、
    測定手法、技術の普及促進

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climate savers smart computing

コンピューティングのエネルギー効率を50%向上

- 5500億ドルのエネルギーコストの削減に相当

年間5400万トンの CO_2 排出を削減

- 相当すること…

1100万台の自動車の削減

20期の火力発電所を廃止

65,000km^{2}の植樹

日本でのアライアンス

- クライメート・セイバーズ・コンピューティング イニシアチブとグリーンIT推進協議会の協働
  - 2008年5月、覚書の締結
  - エネルギー効率の高い IT を実現するため
    - 電源管理の使用を促進
    - 国内外の情報を共有

グリーンIT推進協議会
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climate savers
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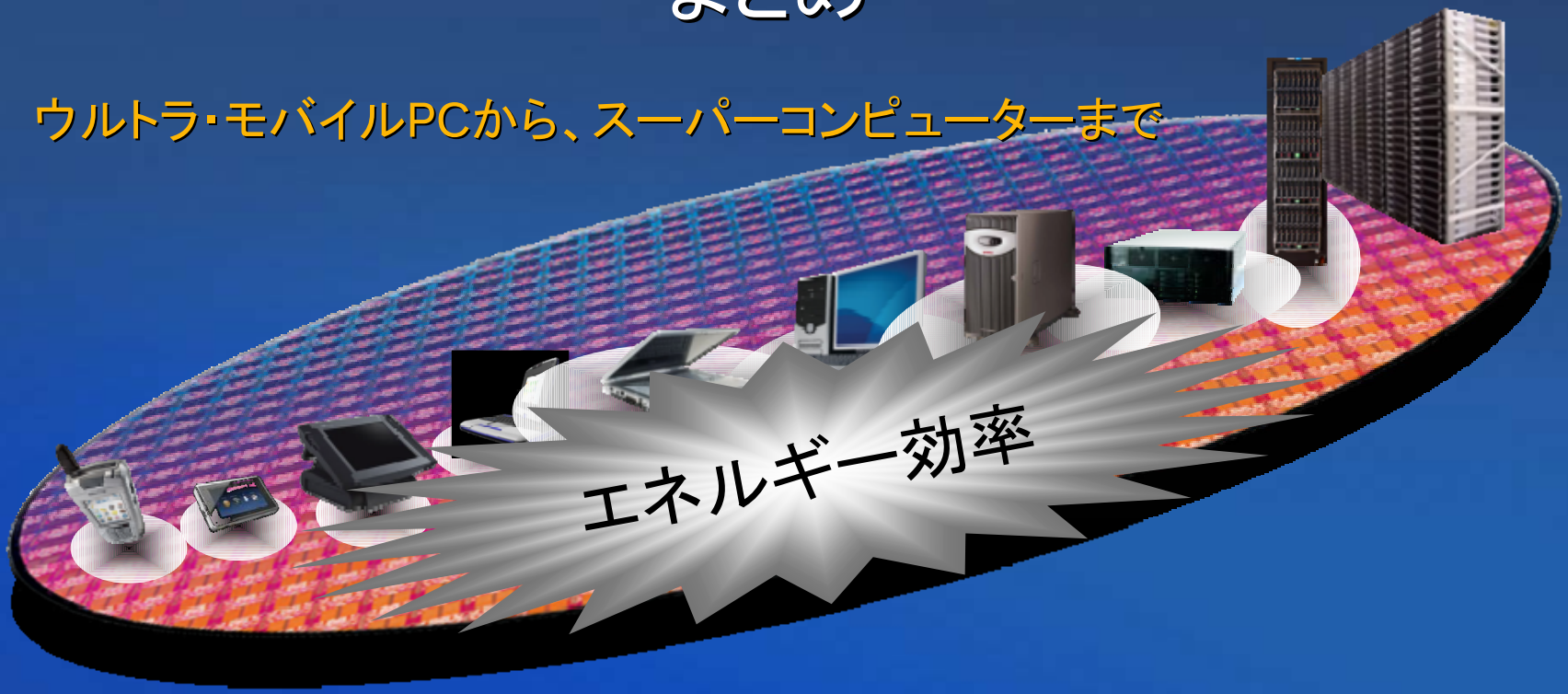
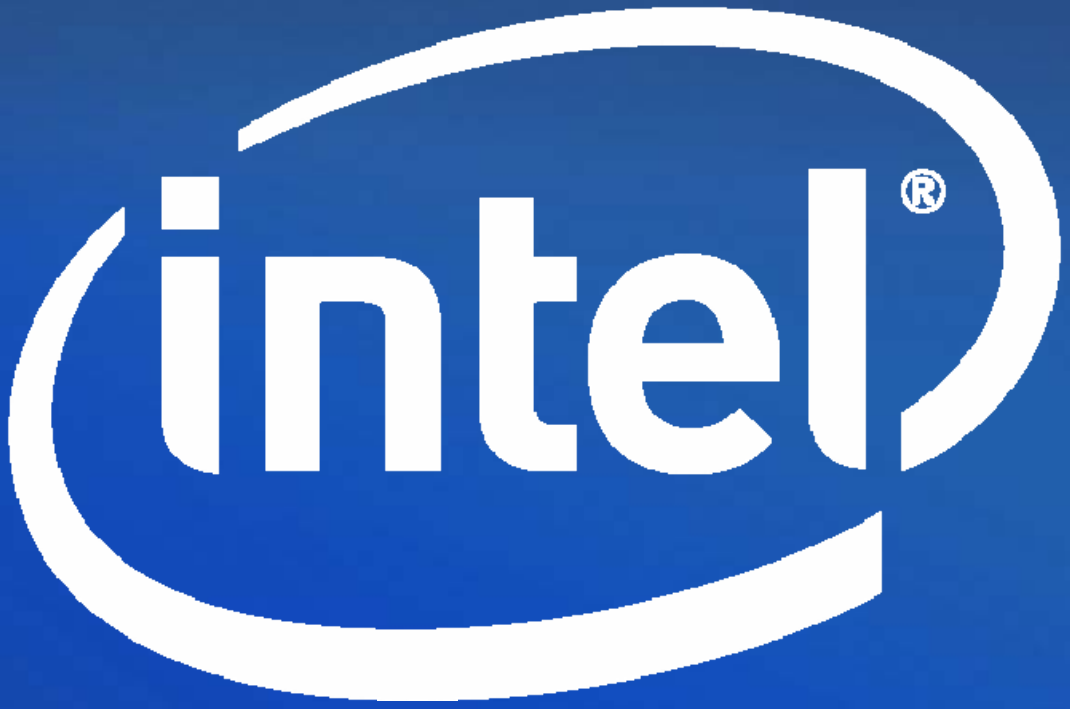
五十音順　敬称略

まとめ

ウルトラ・モバイルPCから、スーパーコンピューターまで



- 高性能でエコフレンドリーな製品開発
- 互換性と拡張性に優れたプラットフォーム（ミリワットからペタフロップ）
- ソフトウェア（業界イニシアティブ含む）とハードウェアの両輪で訴求
- 日立様JP1製品群との強力なテクノロジー連携を実現！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-

Appendix

- **System configuration for slides 25-29**
- Intel® Core™ 2 Duo processor E6550 (2.33GHz, 1333MHz FSB, 4MB L2 Cache), Intel® DQ35JO motherboard with Intel® Q35 Express chipset; 1333MHz FSB, Intel integrated graphics, 2x1GB Micron* DDR2-667 5-5-5-15, Seagate* 320GB/16MB cache/7200rpm, Windows* Vista* Enterprise.

- Intel® Core ™ 2 Duo processor T7700 (2.40GHz/4MB) with 2GB (1x1GB) Dual Channel DS Hynix* DDR2 667 5-5-5-15 memory on **Platform :** Acer* TravelMate* 5720, Intel 965GM Chipset (Intel Chipset 8.3.0.1013) **BIOS** Default Setup, **Graphics:** Intel® Graphics Media Accelerator X3100 (Intel Integrated driver 7.14.10.1280) Resolution 1280 x 800 x 32 bit color, **HDD**: Hitachi* 160GB 5400RPM SATA **Audio Driver**: Conexant* 4.15.0.0 **OS:** Windows* Vista* Ultimate Build 6000 **System Power Management Policy**: AC/High Performance for SYSmark* 2007 Preview and "Balanced Mode" for MobileMark* 2007 **LCD Size**:15.5" WideScreen **Battery Capacity**: 71 Watt-Hours

- Intel® Core ™ Duo processor T2130 (1.86GHz/2MB) with 2GB (1x1GB) Dual Channel DS Hynix* DDR2 667 5-5-5-15 Memory on **Platform :** Acer* TravelMate* 5710, Intel 945GM Chipset (Intel Chipset 8.2.0.1013) **BIOS** Default Setup, **Graphics:** Intel® Graphics Media Accelerator 950 (Intel Integrated driver 7.14.10.1280) Resolution 1280 x 800 x 32 bit color, **HDD**: Hitachi* 160GB 5400RPM SATA **Audio Driver**: Realtek* 6.0.1.5404 **OS:** Windows* Vista* Ultimate Build 6000 **System Power Management Policy**: "Balanced Mode" for MobileMark* 2007 **LCD Size**:15.5" WideScreen **Battery Capacity**: 71 Watt-Hours

Appendix (continued)

- **System information for Slides 18-22:**
- Intel Core 2 Duo processor E6550 (2.33GHz, 1333MHz FSB, 4MB L2 Cache), Intel® DQ35JO motherboard with Intel® Q35 Express chipset; 1333MHz FSB, Intel integrated graphics, 2x1GB Micron* DDR2-667 5-5-5-15, Seagate* 320GB/16MB cache/7200rpm, Windows* Vista* Enterprise,.
- Intel Pentium D Processor 945 (3.4GHz, 800MHz FSB, 2x2MB L2 Cache), with Intel 945G Chipset on Intel D945GPM board, Intel Chipset Software Installation File 8.1.1.1010, Dual Channel Micron* PC2-5300U 2x1GB of DDR2 667 5-5-5-15, Seagate* Barracuda* 320GB NCQ SATA2 7200RPM, Windows* Vista* Ultimate RTM Build 6000 NTFS.
- ACER 5720 Intel Core 2 Duo T7700 (2400MHz/800FSB L2 4MB) with Integrated Graphic,2x1GB Hynix DDR2-667, Hitachi 160GB 5,400rpm HDD
- Display power draw values gathered from spec sheets of 10 models of each type of display (CRT and LCD).
- Energy Cost: 7.705 cents/KWh, which is the U.S. average for industrial and commercial customers as of June, 2007. Source: U.S. Department of Energy, http://www.eia.doe.gov/cneaf/electricity/epm/table5_6_a.html
- Intel EEP methodology is described here: http://www.intelcapabilitiesforum.net/EEP/
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"Data Center Optimization" slide

System configurations and measurement details

System Configurations and Performance / Power Measurements:

2 Socket Intel® Xeon® Processor 3.6GHz (Nocona)
8 x 1GB DDR2-400 DIMMs
System Idle Power: 225W
System Workload Power: 382W
SPECjbb2005 bops performance: 40487

2 Socket Intel® Xeon® Processor E5450 (3.0GHz 80W HTN)
8 x 2GB 667MHz FBDIMMs
System Idle Power: 237W
System Workload Power: 353W
SPECjbb2005 bops performance: 297,984

Claims and Calculations for <2Year ROI refreshing IT servers using 45nm Quad-Core Intel Xeon servers

Calculations

Floor space: 240sq. Foot to 60 sq. foot (83% reduction)
Annual energy costs: 48kW to 6kW (87% reduction)
Yearly Energy Savings: $53k ($61.4k - $8.29k) = $53.11k
Qty 126 2S Intel® Xeon® Processor 3.6GHz (Nacona) servers, at idle power (225W * 16 hours/day), at full load (382W * 8 hours/day), for one year at 0.10 kWh = $30.69k * 2 (HVAC factor) = $61.4k electricity cost per year.
Compared to
Qty 6 2S Intel® Xeon® Processor E5450 (HTN 3.0GHz) servers, at idle power (237W * 16 hours/day), at full load (353W * 8 hours/day), for one year at 0.10 kWh = $4.16k * w (HVAC factor) = $8.29k electricity cost per year.

ROI:
Using HP DL 380G5 with 32GB RAM is $6,264 as of Nov 17, 2007 on hp.com
Cost of 17 servers is $106.5k divided by $53k/year energy savings, this is 2 year ROI

Software:

BEA JRockit* (build P27.4.0-3-86647-1.6.0_02-20070801-1931-windows-x86_64, compiled mode

Source: Intel. Data measured 8/22/07

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Notebook PC Configurations Used for SPEC*CPU 2006 and SYSmark* 2007 Preview

Intel® Mobile Platform	Intel® Centrino®2 Processor Technology	Intel® Centrino®2 with vPro™ Technology	Intel® Centrino®2 with vPro™ Technology
OEM Laptop	Lenovo ThinkPad* T60	Lenovo ThinkPad* T61	Lenovo ThinkPad T400
Processor Name	Intel® Core™ Duo processor T2700	Intel® Core™2 Duo processor T7800	Intel® Core™ 2 Duo processor T9600
Processor Speed	2.33 GHz	2.60 GHz	2.80 GHz
Processor Secondary Cache	2MB Level 2 Cache	4MB Level 2 Cache	6MB Level 2 Cache
Front Side Bus	667 MHz	800 MHz	1066 MHz
Processor Secondary Cache	2MB Level 2 Cache	4MB Level 2 Cache	6MB Level 2 Cache
Chipset	Mobile Intel® 945GM Express Chipset	Mobile Intel® GM965 Express Chipset	Mobile Intel® GM45 Express Chipset
Chipset INF File	Intel® INF 8.1.1.1010	Intel® INF 8.2.0.1012	Intel INF 8.7.0
Platform BIOS	Lenovo* 79ETD7WW 2.17 with default settings	Lenovo* V.7LETA4WW 1.14 with default settings	Pre production Lenovo V.7UET15TE 0.12 with default settings
System Memory	Micron* PC5300 DDR2 667 2x1GB 5-5-5-15	Micron PC26400 DDR2 800 2x1GB 5-5-5-15	Elpida* PC3-8500 DDR3 1067 2x1GB 5-5-5-15
Hard Disk	Hitachi* Travelstar* HTS721010G9SA00 SATA 100GB 7200RPM	Hitachi Travelstar HTS721010G9SA00 SATA 100GB 7200RPM	Hitachi Travelstar HTS722020K9SA00 SATA 200GB 7200RPM
Video Controller	Intel® GMA 950	Intel® GMA X3100	Intel® GMA4500HD
Video Memory Size/Type	224MB Dynamic Video Memory Technology	384MB Dynamic Video Memory Technology	829MB Dynamic Video Memory Technology
Video Driver Version	6.14.10.4926	6.14.10.4926	6.14.10.4907
Graphics	1024x768 resolution, 32-bit color	1024x768 resolution, 32-bit color S	1280x800 resolution, 32-bit color S
Screen Size	14.1" XGA	14.1" XGA	14" WXCA
Sound Card	SoundMAX* Digital HD Audio	SoundMAX Digital HD Audio	Conexant* HD SmartAudio 221
Network Card	Intel® PRO/1000 PL	Intel® 82566MM Gigabit	Intel® 82567LM Gigabit
Wireless Network Card	Intel® PRO/Wireless 3945ABG with driver 11.5.0.36	Intel® Wireless WiFi Link 4965AGN with driver 11.1.1.11	Intel Wireless WiFi Link 5300AGN with driver 12.0.0.59
Screen Size	14.1" XGA	14.1" XGA	14" WXCA
Operating System	Microsoft* Windows* XP Professional, Build 2600, SP2 NTFS	Microsoft Windows XP Professional, Build 2600, SP2 on NTFS	Microsoft Windows XP Professional, Build 2600, SP2 on NTFS
DirectX* Version	DirectX 9.0c	DirectX 9.0c	DirectX 9.0c
Power Management Mode	High Performance	High Performance	High Performance

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- SPECint*_rate_base2006 and SPECfp*_rate_base2006 are capacity-based metrics used to measure throughput of a computer that is performing a number of tasks. This is achieved by running multiple copies of each benchmark simultaneously with the number of copies set to set to the number of logical hardware cores seen by the operating system. SPEC* CPU2006 provides a comparative measure of compute intensive performance across the widest practical range of hardware. The product consists of source code benchmarks that are developed from real user applications. These benchmarks depend on the processor, memory and compiler on the tested system.
- SPEC, SPECint, SPECfp, SPECrate are trademarks of the Standard Performance Evaluation Corporation. For more information go to: www.spec.org/spec/trademarks.html.
- SYSmark* 2007 Preview is BAPCo's latest version of the mainstream office productivity and Internet content creation benchmark tool used to characterize the performance of the business client. SYSmark 2007 Preview

Notebook PC Configurations Used for 3DMark* 06, iTunes*, Sony* Vegas, Adobe*PhotoShop* Elements

Intel® Mobile Platform	Intel® Centrino® processor technology	Intel® Centrino® processor technology	Intel® Centrino®2 processor technology
OEM Laptop	Sony* VAIO* VGN-SZ-440 (Modified)	Sony VAIO VGN-SZ640 (Modified)	Sony VAIO VGN-SR140E (Modified)
Processor Name	Intel® Core™ Duo processor T2700	Intel® Core™2 Duo processor T7800	Intel® Core™2 Duo processor T9600
Processor Speed	2.33 GHz	2.6 GHz	2.8 GHz
Processor Secondary Cache	2MB Level 2 Cache	4MB Level 2 Cache	6MB Level 2 Cache
Front Side Bus	667 MHz	800 MHz	1066 MHz
Chipset	Mobile Intel® 945GM Express Chipset	Mobile Intel® GM965 Express Chipset	Mobile Intel® GM45 Express Chipset
Chipset INF File	Intel INF 8.1.1.1010	Intel INF 8.2.0.1012	Intel INF 8.7.0.1007
Platform BIOS	Phoenix* Technologies LTD V.R0111N0	Phoenix Technologies LTD V.R0111S5	Pre-production Phoenix Technologies LTD V.R0260Y1
System Memory	Quimonda* 2x1GB DDR2-667 4-4-4-12	Quimonda 2x1GB DDR2-667 5-5-5-15	Quimonda 2x1GB DDR2-800 5-5-5-15
Hard Disk	Seagate* ST9160821AS SATA 160GB 5400RPM	Hitachi* HTS722020K9SA00 SATA 200GB 7200RPM	Hitachi HTS722020K9SA00 SATA 200GB 7200RPM
Video Controller	Intel® GMA950	Intel® GMAX3100	Intel® GMA X4500HD
Video Memory Size/Type	224MB Dynamic Video Memory Technology	358MB Dynamic Video Memory Technology	829MB Dynamic Video Memory Technology
Video Driver Revision	7.14.10.1129	7.14.10.1244	7.15.9.2.3.1493
Graphics	1280x800, 32-bit color	1280x800, 32-bit color	1280x800 32-bit color
Screen Size	13.25" WXGA	13.25" WXGA	13.25" WXGA
Sound Card	Sigma Tel* High Definition Audio	Sigma Tel High Definition Audio	Realtek* High Definition Audio
Network Card	Marvell Yukon* 88E8036	Marvell Yukon 88E8055	Marvell Yukon 88E8040
Wireless Network Card	Intel® PRO/Wireless 3945ABG with driver 10.6.0.29	Intel® PRO/Wireless 4965AGN with driver 11.1.0.110	Intel® PRO/Wireless 5100AGN with driver 12.0.0.73
Operating System	Microsoft* Windows* Vista* Home Premium, Build 6001 SP1 on NTFS	Microsoft Windows Vista Home Premium, Build 6001 SP1 on NTFS	Microsoft Windows Vista Home Premium, Build 6001 SP1 on NTFS
DirectX* Version	DirectX 10	DirectX 10	DirectX 10

Benchmark Disclaimer

- Performance is measured on pre-production BIOS for Sony VAIO* VGN-SZ640. Final benchmarks based on the final BIOS may vary from these results. Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. Buyers should consult other sources of information to evaluate the performance of systems or components they are considering purchasing. For more information on performance tests and on the performance of Intel products, visit http://www.intel.com/performance/.
- 3DMark*06 from FutureMark* is a benchmarking tool that combines DirectX* 9.0 support with unique tests and graphics. The CPU Test measures the contribution of the processor on 3D graphical performance while the game test measures game simulation performance.
- Apple* iTunes* 7.6.2 is a digital media application that can be used to manage digital music such as converting from one digital audio format to another. In this case, Apple iTunes is used to convert 61 minutes 24 seconds of music from WAV to MP3 format with a bit rate of 160Kbps for listening on your iPod*.
- Sony* Vegas Movie Studio Platinum * 8.0c is a video editing, audio production, and DVD authoring tool. Using the DivX 6.8 encoder this test shows how long it took to convert and compress a 1 minute 59 second 370MB 1440x1080 HD camcorder video file to a 108MB 1440x1080 HD video file in DivX* format
- Adobe* Photoshop* Elements* 6.0 enables users to organize, edit and enhance photos. This test was run using the “AutoSmartFix” function on 103 jpeg images with an average size of 600KB. Extrapolation used to calculate how many jpeg images you can correct / enhance using the AutoSmartFix function in 5 minutes.

Notebook PC Configurations Used for MobileMark* 2007

Intel® Mobile Platform	Intel® Centrino®2 Processor Technology	Intel® Centrino®2 with vPro™ Technology	Intel® Centrino®2 with vPro™ Technology
OEM Laptop	Lenovo ThinkPad* T60	Lenovo ThinkPad* T61	Lenovo ThinkPad T400
Processor Name	Intel® Core™ Duo processor T2700	Intel® Core™2 Duo processor T7800	Intel® Core™ 2 Duo processor T9600
Processor Speed	2.33 GHz	2.60 GHz	2.80 GHz
Processor Secondary Cache	2MB Level 2 Cache	4MB Level 2 Cache	6MB Level 2 Cache
Front Side Bus	667 MHz	800 MHz	1066 MHz
Processor Secondary Cache	2MB Level 2 Cache	4MB Level 2 Cache	6MB Level 2 Cache
Chipset	Mobile Intel® 945GM Express Chipset	Mobile Intel® GM965 Express Chipset	Mobile Intel® GM45 Express Chipset
Chipset INF File	Intel® INF 8.1.1.1010	Intel® INF 8.2.0.1012	Intel INF 8.7.0
Platform BIOS	Lenovo* 79ETD7WW 2.17 with default settings	Lenovo* V.7LETA4WW 1.14 with default settings	Pre production Lenovo V.7UET15TE 0.12 with default settings
System Memory	Micron* PC5300 DDR2 667 2x1GB 5-5-5-15	Micron PC26400 DDR2 800 2x1GB 5-5-5-15	Elpida* PC3-8500 DDR3 1067 2x1GB 5-5-5-15
Hard Disk	Hitachi* Travelstar* HTS721010G9SA00 SATA 100GB 7200RPM	Hitachi Travelstar HTS721010G9SA00 SATA 100GB 7200RPM	Hitachi Travelstar HTS722020K9SA00 SATA 200GB 7200RPM
Video Controller	Intel® GMA 950	Intel® GMA X3100	Intel® GMA4500HD
Video Memory Size/Type	224MB Dynamic Video Memory Technology	384MB Dynamic Video Memory Technology	829MB Dynamic Video Memory Technology
Video Driver Version	6.14.10.4926	6.14.10.4926	6.14.10.4907
Graphics	1024x768 resolution, 32-bit color	1024x768 resolution, 32-bit color S	1280x800 resolution, 32-bit color S
Screen Size	14.1" XGA	14.1" XGA	14" WXCA
Sound Card	SoundMAX* Digital HD Audio	SoundMAX Digital HD Audio	Conexant* HD SmartAudio 221
Network Card	Intel® PRO/1000 PL	Intel® 82566MM Gigabit	Intel® 82567LM Gigabit
Wireless Network Card	Intel® PRO/Wireless 3945ABG with driver 11.5.0.36	Intel® Wireless WiFi Link 4965AGN with driver 11.1.1.11	Intel Wireless WiFi Link 5300AGN with driver 12.0.0.59
Screen Size	14.1" XGA	14.1" XGA	14" WXCA
Operating System	Microsoft* Windows* XP Professional, Build 2600, SP2 NTFS	Microsoft Windows XP Professional, Build 2600, SP2 on NTFS	Microsoft Windows XP Professional, Build 2600, SP2 on NTFS
DirectX* Version	DirectX 9.0c	DirectX 9.0c	DirectX 9.0c
Power Management Mode	Portable/Laptop	Portable/Laptop	Portable/Laptop

Benchmark Disclaimer

- MobileMark* 2007 is a benchmark used to evaluate notebook PC user experience by measuring both performance and battery life at the same time on the same workload. MobileMark 2007 was released in August 2007 and contains workloads that are updated from those found in MobileMark* 2005. Because the workloads within MobileMark 2007 and MobileMark 2005 are different and operating system features between Microsoft Windows XP* and Microsoft Windows Vista* also differ, it is not meaningful to compare the performance scores or battery life results of these two benchmarks.

Configuration details for broad claims

- Up to nearly 50% performance gain and up to 10% reduction in platform power claim details. Results as of September 2008

- Performance gain claim based on TPC-E Benchmark details

Intel® Xeon® processor X7350 based platform details

Fujitsu Simens* Primergy RX600 S4 server platform with four Intel® Xeon® Processors X7350 2.93GHz, 2x4MB L2 cache, 128GB (32x4GB) memory, Microsoft SQL Server 2008 Enterprise x64 Edition, Microsoft Windows Server 2008 Enterprise x64 Edition, TPC-E 492.32; Price/Performance: 559.88 US $. Availability Date 1/1/09; Processors/Cores/Threats - 4/16/16; Application benchmark performance certified on Sept 10, 2008 by Fujitsu Simens.

Intel® Xeon® processor X7460 based platform details

IBM* System x 3850 M2 server platform with four Intel® Xeon® Processors X7460 (2.66GHz, 16MB L2 cache, 6 cores), 128GB memory, Microsoft SQL Server 2008 Enterprise x64 Edition, Microsoft Windows Server 2008 Enterprise x64 Edition, TPC-E 729.65; Price/Performance: 457.27 US $. Availability Date 10/31/08; Processors/Cores/Threats - 4/24/24; Application benchmark performance certified on Sept 15, 2008 by IBM.

- Reduced Platform power claim based on vConsolidate Benchmark on VMware ESX Server results

Comparison between Intel® Xeon® Processor 7400 and 7300 Series based on vConsolidate benchmark result measured on Vmware ESX Server v3.5.0 by Intel corporation in September 2008.

Intel Xeon processor X7460 and X7350 based platform details:

Intel server software development platform (Foxcove) with four Intel Xeon processors X7460 (2.66GHz, 16M L3 Cache, 6-cores) or X7350 (2.93GHz, 8M L2 Cache, 4-cores) 1066 MHz system bus, 8MB L2 cache, Clarksboro chipset, 16x2GB memory FBD PC2-5300F, maximum performance achieved using five CSUs for X7350 and 6 CSUs for X7460. vConsolidate version 2.0 profile 2. Platform power measured as part of the performance measurement showed a 11% reduced power consumption while delivering peak performance