UPC Solutions Manual

Ultra Personal Computer

Transmeta
CORPORATION

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What is a UPC?

The Ultra-Personal Computer (UPC) - a new computing category enabled by Transmeta processors - is a high-performance, full-featured personal computer that delivers the functionality of a desktop computer and the features of a laptop computer in the size of a handheld PDA.

Industry standard components and connectivity features differentiate UPCs from other handheld devices. UPCs are designed to run full x86 desktop operating systems and applications, including Microsoft® Windows® XP Professional and Home Edition, giving users application independence and the freedom to use their data with the software of their choice.

By consolidating computers and data into a single UPC, users can dramatically simplify or even eliminate the synchronization between multiple devices. This allows companies to benefit from increased productivity and reduced IT maintenance overhead while providing users with seamless portability of their data and multimedia content.

For a computer to earn the UPC designation, it must not only adhere to performance and compatibility requirements, it must fit into a standard jacket pocket. This requirement has placed severe limitations upon electronic and component manufacturers, especially in the areas of processing. For Transmeta, this was never a concern due to the minimal footprint, low power consumption and reduced thermal disspation of Transmeta processors.

A small, fully functional "pocketable" PC could not have been achieved without the Transmeta Crusoe processor. In fact, Transmeta's next-generation, high-performance processor, the Efficeon, is the only other x86 processor capable of powering the UPC form factor. The integration of Northbridge chipset functionality onto Transmeta processor die further enhances compact form factors, allowing for newer more innovative designs.

This has made Transmeta the only viable processor solution in the UPC category, allowing UPC manufacturers to deliver uniquely capable devices that lead the industry in innovation, standards, and integration.

The goal of the UPC is simple: to create a practical, functional computer capable of running Windows XP and standard desktop applications that fits in the palm of the hand. To that end, Transmeta is working closely with hardware and software partners to ensure the success of the UPC market.

- UPCs offer portability and modularity without sacrificing functionality.
- Transmeta processors inherently provide low power consumption and reduced heat dissipation - two important characteristics for UPC designers and customers wanting to build UPCs without heat pipes, large heat sinks and fans.

Products

"Ever since I saw one of the first prototypes of an ultra-personal computer (UPC), also called a modular computer, nearly five years ago at IBM, I've been a beliver. The idea of a full capable computer that can fit in your purse or shirt pocket was incredibly compelling to me after years of carrying luggable lap anchors."
- Rob Enderle, principle analyst, Enderle Group

http://www.eweek.com/article2/0,4149,1375248,00.asp
Can OQO Popularize the Ultra-PC?
Eweek

efficēon PROCESSOR

Transmeta CORPORATION

Product Sheet

Transmeta™ Efficeon™ TM8600 Processor

The Transmeta Efficeon x86 compatible processor ushers in a new era of energy efficient computing. The processor was designed from the start to address the ever-growing demand for power-efficient x86 solutions. To maximize performance and responsiveness, the Efficeon processor features a 256-bit wide VLIW engine that can execute up to 8 instructions per clock cycle, a large 1 MB L2 cache, and support for SSE & SSE2 instructions for a compelling multimedia experience. The I/O interfaces built into the Efficeon processor's integrated Northbridge are matched with its high performance core featuring support for DDR-400 DRAM, a 1.6 GB/s HyperTransport™ interconnect, and an AGP 4X graphics interface. With the new Code Morphing Software for the Efficeon processor, Transmeta extends its leadership in power management, offering a solution that provides high performance while consuming less power for the same work. The result is a highly efficient x86 solution suitable for notebook computers, Tablet PC's and many other applications where an integrated, low power x86 processor is desirable.

HIGH PERFORMANCE

8 Instruction Issue, 256-Bit VLIW Engine

- Fully Pentium 4-ISA compatible
- Up to eight instructions issued per clock cycle
- Up to 50% improvement in integer applications
- SSE and SSE2 multimedia extensions enables multimedia applications to run up to 80% faster per clock cycle than previous generation processors from Transmeta
- Large 1 MB L2 cache improves processor performance

Advanced Code Morphing Software

- Improves performance and responsiveness over 1st generation Transmeta Crusoe technology
- Unique software based architecture is key to reducing power consumption and enabling future scalability and flexibility
- New generation Code Morphing Software technology leverages 256-bit VLIW hardware advances
- Enables quick, low cost improvements to performance and power consumption with updates of Code Morphing Software

HIGHLY INTEGRATED ARCHITECTURE

Fully Integrated Northbridge Core Logic

- On-chip DDR-400 memory interface
- Integrated AGP 2.0 compliant graphics interface for industry standard, high performance graphics solutions at 1X, 2X & 4X data rates
- On-chip 400 MHz HyperTransport™ interface, 8-bits wide in each direction, provides 12x the I/O throughput compared to 32-bit, 33 MHz PCI.
- Full support for ECC in L2 cache and northbridge memory controller enables expansion into the server market.

Enables Small Form Factor Designs

- Northbridge integration reduces system chip count, power consumption and PCB size

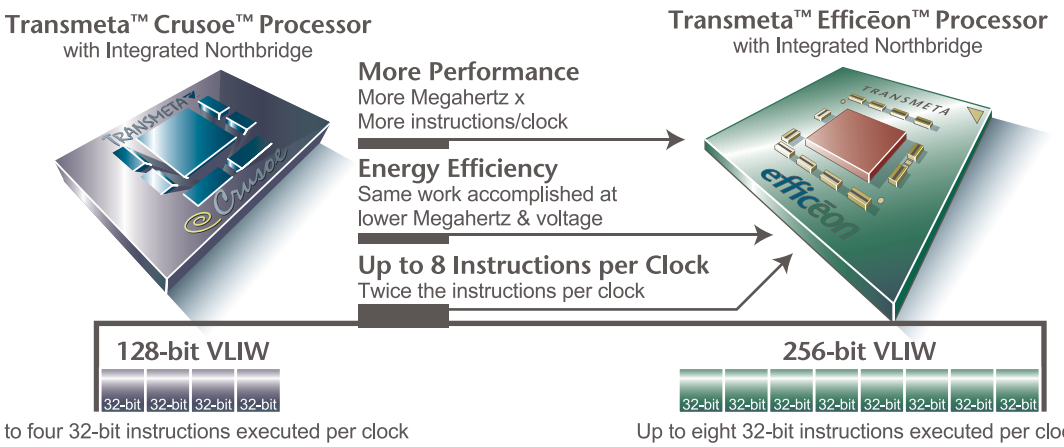
ENERGY EFFICIENT DESIGN

Enhanced LongRun™ Dynamic Power Management

- Enables longer battery life by dynamically adjusting operating frequency and voltage to match the performance requirements of application workloads
- Provides higher performance within smaller, thermally constrained environments

Enhanced LongRun Thermal Management

- Maximizes performance within a thermal envelope
- Low thermal characteristics enable fanless designs for quieter and more reliable systems



Transmeta Efficeon TM8600 Processor

Transmeta Efficeon Processor Core

At the heart of the Transmeta Efficeon processor is a state-of-the-art VLIW (Very Long Instruction Word) hardware engine that uses a custom, efficient VLIW instruction set. Running on the processor is Transmeta's proprietary Code Morphing Software (CMS), the Efficeon software component that dynamically optimizes and translates x86 instructions into VLIW native code. This unique combination of hardware and software allows the processor to be more efficient, and also adds intelligence to Efficeon not found in other x86 microprocessors to manage power consumption and heat.

Smallest Solution Footprint

	Component	Package
CPU	Efficeon	841mm²
Northbridge	(included)	
	Total	841mm²
CPU	Pentium-M	1232mm²
Northbridge	855PM	1406mm²
	Total	2638mm²

Efficeon is less than 1/3 the size of Pentium-M and 855PM

Source: *http://www.intel.com — Intel® Pentium® M Processor Datasheet, June 2003; Intel® 855PM Chipset Memory Controller Hub (MCH) DDR 200/266 MHz Datasheet, March 2003*

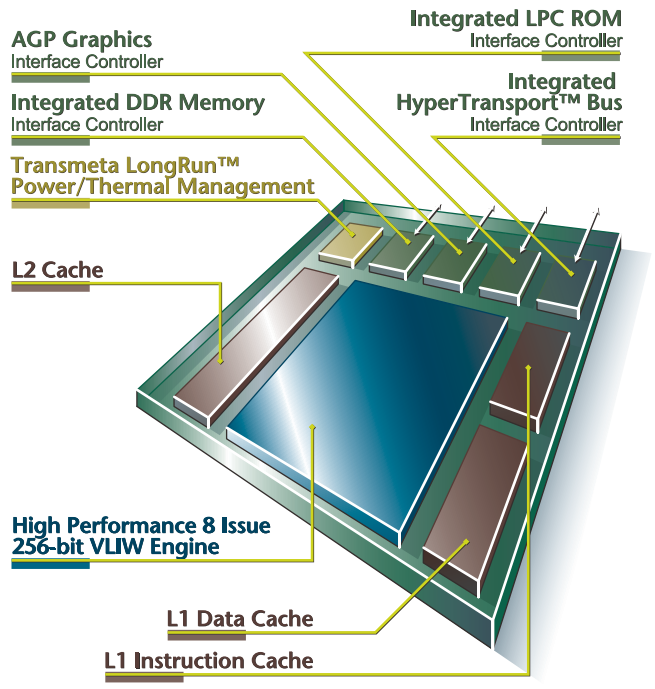
Transmeta Enhanced LongRun Power Management

Unlike conventional x86 processors, Transmeta's Enhanced LongRun power management technology is part of the Efficeon processor's Code Morphing Software. This combination allows the Efficeon processor to seamlessly adjust its operating frequency and voltage up to hundreds of times per second — dramatically extending battery life, limiting heat dissipation yet providing rapid system responsiveness.

Quarter used to show relative size.

Transmeta™ Efficeon™ Processor

Block Diagram



Transmeta Efficeon TM8600 Processor

Specifications	
On-die L1 Instruction Cache	128KB
On-die L1 Data Cache	64KB
On-die L2 Write-Back Cache	1 MB
HyperTransport System Bus Speed	800 Megatransfers/s
Aggregate HyperTransport Link Bandwidth	1.6 GB/s
MMX, SSE, SSE2 Instruction Support	Yes
Fully Integrated Northbridge Functionality	Yes
Integrated AGP 1X, 2X, and 4X graphics interface	Yes
Support for DDR-266, 333, 400 memory	Yes
Support for ECC memory	Yes
Integrated Low Pin Count Bus (LPC)	Yes
Full x86 Software and OS Compatibility	Yes
Enhanced LongRun Thermal Management	Yes
Enhanced LongRun Power Management	Yes
Package Size	29mm x 29mm

For more information, visit **www.transmeta.com**

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Crusoe™ PROCESSOR

Transmeta CORPORATION

Product Sheet

Transmeta™ Crusoe™ TM5700/TM5900 Processors

New Energy Efficient Designs with a Small Form Factor Package

Product Overview

Transmeta, the leader in efficient computing introduces the next generation of the Crusoe family of microprocessors. The new Transmeta Crusoe TM5700 and TM5900 processors are available in compact 21mm x 21mm package — a form factor that is 54% smaller than previous Crusoe processors. This makes them ideal for ultra-compact mobile and embedded designs.

The small footprint of Transmeta Crusoe TM5700/TM5900 processors have an optimized pin-out designed to enable 4-layer PCB designs to reduce overall costs for producing high-volume implementations. The smaller package size also makes them ideal for applications that require high performance processing within small and thermally constrained environments including ultra-personal computers (UPCs), thin clients, notebooks, web tablets, industrial control, general embedded, point-of-sale, portable consumer devices, set top boxes and many other applications.

The Transmeta Crusoe processor is based upon a custom efficient instruction set that offers a number of compelling advantages, the most important of which is a reduction in the number of power hungry logic transistors used inside the processor core. This streamlined processor design allows the Crusoe processor to benefit from a greater performance-to-power ratio while keeping heat dissipation to a minimum.

Crusoe TM5700/TM5900
21mm x 21mm

US Quarter
24mm

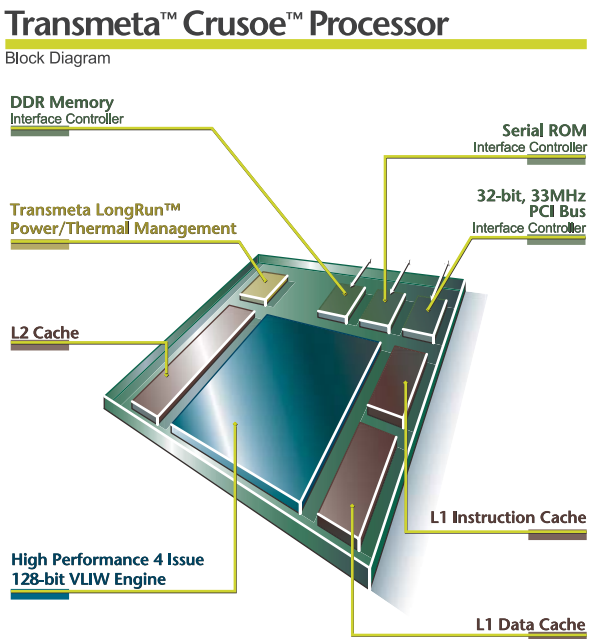
Quarter used to show relative size

Transmeta Crusoe Processor

Specifications	Crusoe TM5900 Processor	Crusoe TM5700 Processor
Frequency	800MHz - 1GHz	667MHz
On-die L1 Instruction Cache	64 KB	64 KB
On-die L1 Data Cache	64 KB	64 KB
On-die L2 Write-Back Cache	512 KB	256 KB
Integrated Northbridge Functionality	Yes	Yes
Integrated DDR Memory Controller	Supports DDR-266 SDRAM memory	Supports DDR-266 SDRAM memory
Integrated PCI Interface	32-bit, 33MHz PCI	32-bit, 33MHz PCI
Full x86 Software and OS Compatibility	Yes	Yes
LongRun Power Management	Yes	Yes
LongRun Thermal Management	Yes	Yes
Package Type	Compact 399-contact FC-OBGA package	Compact 399-contact FC-OBGA package
Package Size	21mm x 21mm	21mm x 21mm
Manufacturing Process	0.13µm	0.13µm
Max. Thermal Design Power	As low as 6.5W - 9.5W (includes integrated northbridge)	As low as 5.1W (includes integrated northbridge)
Availability	Now	Now

Transmeta Crusoe Architecture

Crusoe TM5700/TM5900 processors incorporate integer and floating-point execution units, separate instruction and data caches, a level 2 write-back cache, memory management unit, and multimedia instructions. In addition to these traditional processor features, the devices integrate Northbridge functionality, including a DDR SDRAM controller, PCI bus controller and serial ROM interface controller.



Integrated Northbridge Controller

Power consumption and thermal dissipation within the sytem has been reduced by integrating Northbridge controller functionality directly onto the processor core. This functionality — consisting of a DDR DRAM memory controller, a serial ROM interface, and a PCI bus controller — simplifies system design, reduces board space, enhances performance, and reduces costs. As a separate chip, a Northbridge chipset consumes 2-3 watts of additional power. In comparison, Transmeta's northbridge power is included in the Crusoe processor's low thermal design power.

128-Bit VLIW Processor Core

The Crusoe TM5700/TM5900 processor core architecture is relatively streamlined compared to conventional x86 processors. It is based on a very long instruction word (VLIW) 128-bit instruction set that can issue up to 4 instructions per clock cycle. Within this VLIW architecture, the control logic of the processor is reduced and software is used to control the scheduling of instructions. This allows for a very straightforward hardware implementation with an in-order 7-stage integer pipeline and a 10-stage floating-point pipeline. By streamlining the processor hardware and reducing the control logic transistor count, the performance-to-power consumption ratio (energy efficiency) can be greatly improved over conventional x86 architectures.

Code Morphing™ Software (CMS)

CMS — the software component of the Transmeta Crusoe processor — translates x86 instructions into highly optimized and extremely fast VLIW native instructions which are then processed with great efficiency. To optimize performance, frequently used translations are cached for subsequent reuse, further enhancing performance over standard x86 architectures.

Transmeta LongRun™ Power & Thermal Management

Transmeta LongRun power management technology further reduces thermal constraints by dynamically adjusting the operating voltage and clock frequency of the processor core based on application demands and intelligently adapts processor operation to system thermal environments. By evaluating the demand on the processor, LongRun delivers enough performance to satisfy the workload at hand. This conserves power and improves battery life. If desired, LongRun can be configured to deliver different performance characteristics depending on the application. Best of all, Transmeta LongRun technology provides more responsiveness than conventional power management schemes used by operating systems and is completely transparent to the end-user.

For more information, visit **www.transmeta.com**

Crusoe™ PROCESSOR

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Product Sheet

Transmeta™ Crusoe™ TM5900 System Development Kit

Standard Mini-ITX Form Factor Design

Product Overview

The Transmeta Crusoe TM5900 System Development Kit is an evaluation/reference platform designed around the new energy efficient Crusoe TM5900 microprocessor. The Crusoe model TM5900 processor uses a new small form factor package that is only 21mm x 21mm in size, making it perfect for compact mobile and embedded designs.

Efficeon TM5900 System Features & Benefits

- High performance, low power, fanless 1GHz Mini-ITX platform.
- Cost effective design with 4-layer PCB design.
- Kit comes with schematics, Gerber files, BOM, software drivers for Microsoft® Windows® XP, Windows Embedded XP and Windows CE.NET®, and Linux to enable a quick and easy evaluation with the tools needed to move quickly into production.
- Uses Transmeta's LongRun® Thermal and Power Management technologies to deliver the maximum performance with the minimum heat and power consumption.
- Phoenix Technologies BIOS on board.

Development Kit Specifications

Processors Supported	Transmeta Crusoe TM5900 1GHz processor
Chipset	Northbridge: Integrated into TM5900 processor Southbridge: ALI® M1535+
BIOS	Phoenix Technologies™ BIOS supporting ACPI, DMI and PnP
System Memory	1 x DIMM socket for DDR266 SDRAM memory modules
Bus Master ATA	ALI M1535+ built-in two ATA-100 ATA interface supporting up to 4 devices
On-board VGA	SiS® 315T 2D/3D VGA controller with 8MB VGA memory Optional SiS 301B video companion supporting CRT, TV-out and TMDS for TFT LCD panels
On-board Audio	ALI M1535+ built in audio controller AC97 Codec WM9708 Connectors for line-in, line-out and microphone
On-board Ethernet	Realtek 8139D single chip Ethernet controller 10/100 BaseT support, full duplex, Wake-On-Lane RJ-45 connector (rear side)
Expansion Slots	1 x PCI slot with separate PCI expansion card for 2 additional PCI slots
I/O Features	1 x Parallel port (EPP, ECP Port) 1 x Serial port (RS232)
USB	2 x USB 1.1/2.0 ports using ALI M5273 USB 2.0 controller Pin header for two additional USB 1.1 ports
IrDA	Pin header
Keyboard / Mouse	1 x PS/2 Mouse connector 1 x PS/2 Keyboard connector
Form Factor	Mini-ITX form factor motherboard 6.7-inch x 6.7-inch (170mm x 170mm)
Power Supply	Standard ATX

128-Bit VLIW Processor Core

The Crusoe TM5900 processor core architecture is relatively streamlined compared to conventional x86 processors. It is based on a very long instruction word (VLIW) 128-bit instruction set that can issue up to 4 instructions per clock cycle. Within this VLIW architecture, the control logic of the processor is reduced and software is used to control the scheduling of instructions. This allows for a straight forward hardware implementation with an in-order 7-stage integer pipeline and a 10-stage floating-point pipeline. By streamlining the processor hardware and reducing the control logic transistor count, the performance-to-power consumption ratio (energy efficiency) can be greatly improved over conventional x86 architectures.

System Development Kit Contents

The Transmeta Crusoe TM5900 System Development Kit comes with a full complement of accessories including:

- CD-ROM drive inverter and power cable adapter
- IDE and floppy drive cables
- USB connector and cables
- COM connector brackets and cables

A CD-ROM containing:

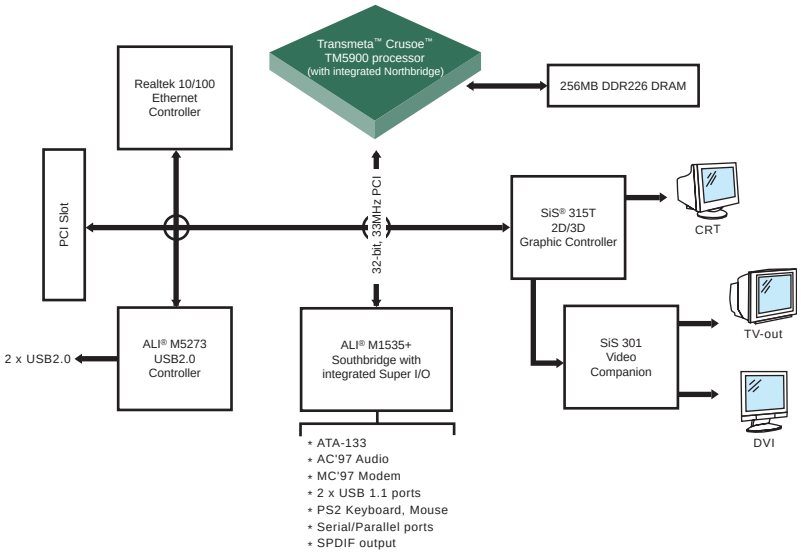
- User's Guide
- Device drivers
- Reference design files and Crusoe processor specification
- BIOS and microcode upgrade tools
- LongRun™ power management monitor and control application

Small Form Factor Features

The Transmeta Crusoe TM5900 System Development Kit implements all the functions of a versatile PC system, including onboard video/graphics, audio and Ethernet in a 17cm x 17cm form factor. System memory is provided with standard memory slot for DDR DIMM modules. Other advanced features include USB 1.1/2.0 ports, an IrDA interface, S-Video output and a digital S/PDIF audio output. The Phoenix Technologies BIOS used with the TM5900 Mini-ITX motherboard facilitates easy system configuration and peripheral setup.

Full x86 Compatibility

Transmeta Crusoe processors provide full x86-compatible software execution and seamless operation with all standard x86-compatible operating systems including Microsoft® Windows®, Microsoft CE.NET, Linux, and a variety of real time operating system (RTOS). Transmeta works closely with partners, customers and commercial laboratories to ensure validated interoperability and continued adherence to high quality and reliability standards.



Transmeta Crusoe TM5900 Development Kit
part number: 800922

For more information, visit **www.transmeta.com**

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Product Sheet

Transmeta™ Efficeon™ TM8600 System Development Kit

Efficient Computing Reference Platform

Product Overview

The Transmeta Efficeon TM8600 System Development Kit is a reference platform using the latest innovations in efficient computing for the evaluation and prototyping of hardware designs. To ensure a high-performance competitive architecture, Transmeta has partnered with NVIDIA to offer its nForce3 Pro 250 Gb Southbridge technology for a compelling platform featuring many cutting-edge technologies required for modern computing designs such as Serial ATA, Gigabit Ethernet and AGP 8X. This makes the Transmeta Efficeon TM8600 System Development Kit ideal for the development of notebooks, Tablet PCs, silent PCs, embedded servers, blade servers, SOHO servers, set top boxes, and other consumer and enterprise devices.

The System Development Kit features the Transmeta Efficeon processor; a microprocessor characterized by low power consumption, reduced heat dissipation and the performance required to run the latest x86 compatible applications and operating systems. It is further enhanced by full support for SSE and SSE2 multimedia extensions, enabling multimedia applications to run up to 80% faster per clock cycle than previous generation processors from Transmeta.

Development Kit Specifications

Processors Supported	Transmeta Efficeon TM8600 processor
Chipset	Northbridge: Integrated into Efficeon processor Southbridge: NVIDIA® nForce3™ Pro 250 Gb
BIOS	Phoenix Technologies™ BIOS supporting ACPI, DMI and PnP
System Memory	2 x DDR SO-DIMM sockets Up to 4GB of total memory
On-board IDE	2 x ATA-133 interfaces supporting up to 4 devices
On-board Serial ATA	2 x Serial ATA interfaces supporting up to 4 devices
On-board Audio	NS LM4549 AC'97 compliant Codec Audio line-in, line-out and microphone connectors
On-board Ethernet	NVIDIA nForce3 Pro 250 Gb built-in Gigabit Ethernet controller
Expansion Slots	1 x AGP 8X slot 2 x PCI slots
USB	2 x USB 2.0 ports On-board headers for 2 additional USB ports
I/O Features	1 x Serial port (RS232) 1 x Parallel port (DB25 IEEE1283)
Keyboard / Mouse	1 x PS/2 Mouse connector 1 x PS/2 Keyboard connector
Form Factor	FlexATX form factor motherboard 9.0-inch x 7.5-inch (228mm x 190mm)
Power Supply Input	19V/5A AC-DC adaptor, or 12.6V_max battery pack

Unlike traditional microprocessor architectures, the Efficeon processor has full integrated Northbridge functionality — including an integrated DDR-DRAM memory controller, AGP controller, LPC interface and a high-speed HyperTransport™ interface. This level of integration completely removes the need for an external Northbridge chip, reducing board space, lowering power and enhancing performance, and easing system design.

High Performance 256-Bit VLIW Engine

To maximize performance and responsiveness, the Efficeon processor features a state-of-the-art 256-bit-wide VLIW (Very Long Instruction Word) engine that can issue up to 8 instructions per clock cycle. A large 1MB L2 cache and support for SSE & SSE2 instructions help make for a compelling multimedia experience. The Efficeon processor is a unique hardware/software design. The hardware engine processes instructions like a conventional processor, but runs a custom, efficient instruction set. Transmeta's proprietary Code Morphing™ Software (CMS) is the software component of the Efficeon processor. CMS dynamically optimizes and translates x86 instructions into VLIW native code that the VLIW hardware engine can process. This unique combination of hardware and software allows the processor to be more streamlined and adds intelligence to the Efficeon processor not found in other x86 microprocessors.

System Development Kit Contents

The Transmeta Efficeon TM8600 System Development Kit comes with a full complement of accessories including:

- IDE and floppy drive cables
- CD-ROM driver inverter and power cable adapter
- USB connector brackets and cables
- COM connector brackets and cables
- Laptop or chassis mounted power supply
- Manual (printed or CD-ROM) with schematics and bill of materials

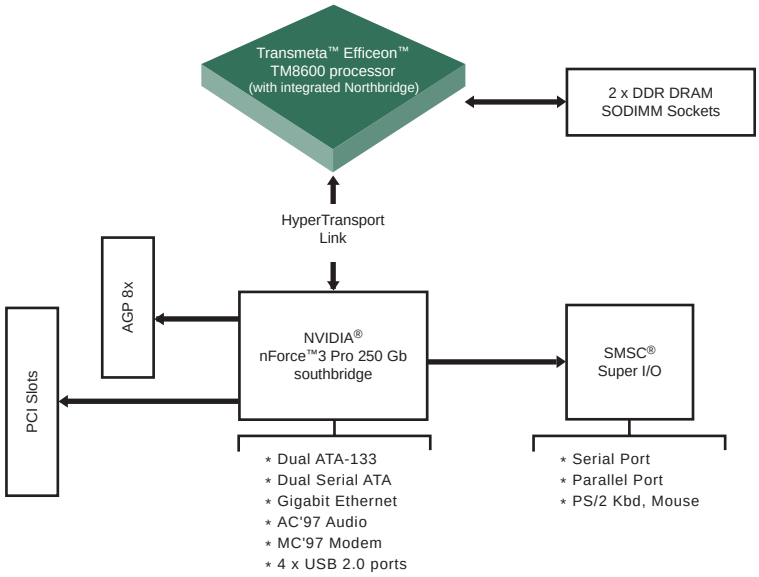
A CD-ROM containing:

- User's Guide
- Device drivers
- Reference design files and Efficeon™ processor specification and design guide documents
- BIOS and microcode upgrade tools

LongRun™ Power Management

LongRun power management technology provides Code Morphing software with the ability to adjust the Efficeon processor core operating voltage and clock frequency dynamically, depending on the demands placed on the processor by software. Because power varies linearly with clock speed and by the square of voltage, adjusting both processor voltage and clock frequency can produce cubic reductions in power consumption, whereas conventional processors can adjust power linearly only by adjusting the effective operating frequency.

The Long Run power management policies are implemented within Code Morphing software, and can detect different workload scenarios based on runtime performance information, and then exploit these by adapting processor power usage accordingly. This ensures the processor delivers high performance when necessary and conserves power when demand on the processor is low. All power adjustments are transparent to the operating system, power management controller, and the user.



For more information, visit **www.transmeta.com**

Transmeta Efficeon TM8600 Development Kit
part number: 800950

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Crusoe™ PROCESSOR

Transmeta CORPORATION

Product Sheet

Transmeta™ Crusoe™ TM5800 System Development Kit

Small Micro-ATX Form Factor Design

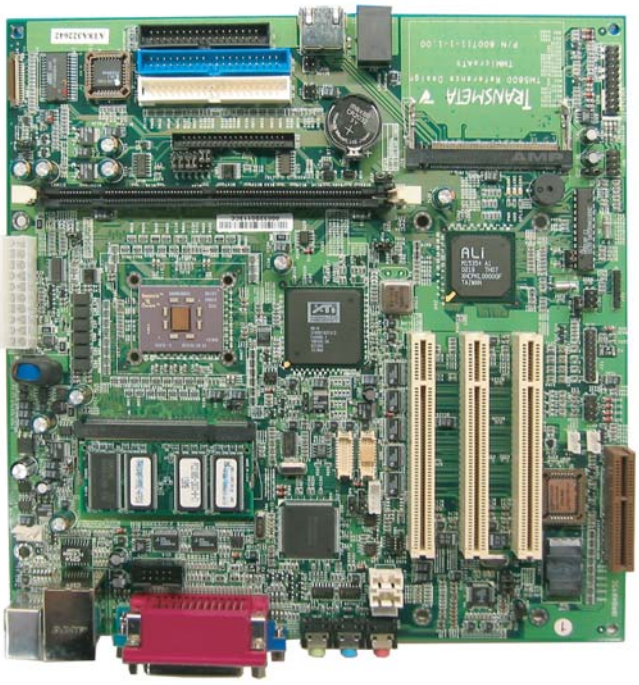
Product Overview

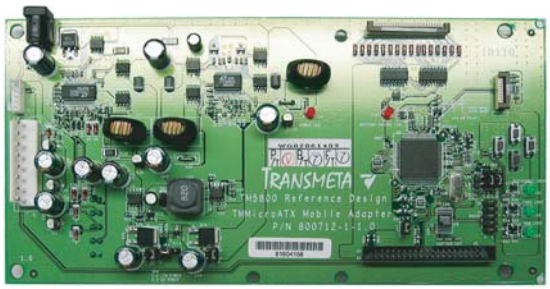
Transmeta, the leader in efficient computing, provides a total system solution for developing very fast and highly integrated x86 devices. The Transmeta Crusoe TM5800 System Development Kit is a cost-effective platform that enables developers to easily design many different products including PCs, mobile PCs, POS devices, smart displays, thin clients, industrial automation, and full-featured embedded devices.

The System Development Kit features the Transmeta Crusoe TM5800 1GHz or Crusoe SE TM5800 800MHz processor with Code Morphing™ Software providing high-performance for demanding applications, high energy efficiency for long battery life, low power dissipation and heat generation, and LongRun™ power and thermal management.

Development Kit Specifications

Processors Supported	Transmeta Crusoe TM5800 1GHz processor or Crusoe SE model TM5800 800MHz processor
Chipset	Northbridge: Integrated into TM5800 processor Southbridge: ALI® M1535+
BIOS	Phoenix Technologies™ BIOS, supports ACPI, DMI, PnP
System Memory	1 x DDR socket with 256MB DDR-266 module 1 x DIMM socket for SDRAM memory modules
Bus Master ATA	ALI M1535+ built-in two IDE interfaces for up to 4 devices: Supports PIO mode 3/4 or Ultra DMA/33/66/100 IDE HDD, and ATAPI CD-ROM
On-board VGA	ATI® M6 VGA controller with 8MB VGA memory Supports CRT, Svideo, TV-out, DVI, LVDS
On-board Audio	ALI M1535+ built in audio controller AC97 Codec STAC9721T Connectors for line-in, line-out, microphone, CD-In, Aux-In
On-board Ethernet	NS DP83815 single chip Ethernet controller 10/100 BaseT support, full duplex, Wake-On-LAN RJ-45 connector (rear side)
Expansion Slots	3 x PCI slots 1 x MiniPCI slot 1 x CNR slot
I/O Features	1 x FDD (up to 2.88MB, 3 Mode) 1 x Parallel port (EPP, ECP Port) 2 x Serial ports (RS232)
USB	2 x USB port connectors plus pin header for two additional USB ports
Thermal Sensor	Maxim 1617
IrDA	Pin header
Keyboard / Mouse	1 x PS/2 mouse connector 1 x PS/2 Keyboard connector
Form Factor	Standard MicroATX motherboard 9.6-inch x 9.6-inch (243.8mm x 243.8mm)





The kit also includes Hitachi's H8 Mobile Daughterboard that provides the included TM5800 MicroATX motherboard with the capability to run in a battery-powered mobile configuration with a matrix keyboard and touch pad.

Evaluation Software

The Crusoe System Development Kit has board support packages for the following operating systems: Microsoft Windows XP®, Microsoft CE.NET®, Lynux Works™ BlueCat Linux® and LynxOS, MontaVista™ Linux Professional Edition, QNX® Neutrino®, and Wind River® VxWorks®.

Transmeta Software Tools

LongRun™ Monitor is a graphical tool displaying the LongRun power management performance (MHz and voltage) of the Transmeta Crusoe and Crusoe SE processor over time. This utility provides flexible management of system performance and battery life. An additional suite of Transmeta software tools is also available.

Development Kit Contents

The Transmeta Crusoe TM5800 System Development Kit comes with a full complement of accessories including:

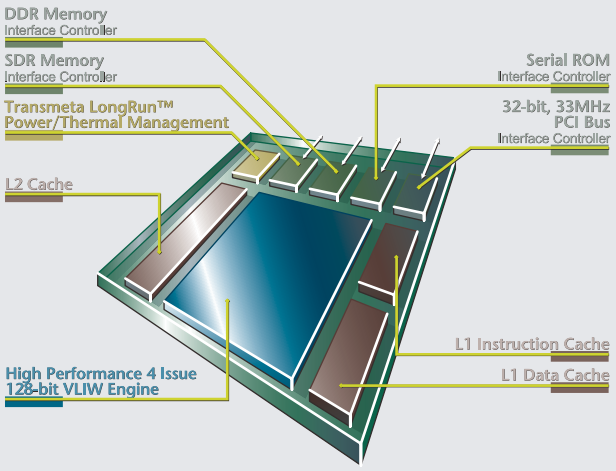
- MicroATX motherboard and Hitachi H8 controller board
- Video connector bracket adapters
- LCD panel power/control cables
- CD-ROM drive inverter & power cable
- IDE and floppy drive cables
- USB 1.1 connector and COM cables
- Matrix keyboard with integrated flex cable
- Touchpad and flex cable
- Lithium Ion battery
- AC power adapter and power cord
- Complete documentation on CD-ROM
- Board schematics in OrCAD and PDF formats
- 6 month warranty

BIOS Support

Transmeta Crusoe and Crusoe SE processors are compatible with the major BIOS manufacturers including Phoenix Technologies™, American Megatrends Inc., Insyde Software, Inc.™, and General Software™.

Transmeta™ Crusoe™ Processor

Block Diagram



L1 Data Cache: 64KB
L1 Instruction Cache: 64KB
L2 Cache: 512KB
DDR Memory Support: DDR-SDRAM 100-133MHz
SDR Memory Support: SDR-SDRAM 66-133MHz
Processor Package: Compact 474-pin Ceramic BGA

Side-view of the Transmeta Crusoe TM5800 Reference Board

For more information, visit **www.transmeta.com**

Embedded Development Kit part number:
5800-800-800810 for 800 MHz

Embedded Development Kit part number:
5800-1000-800792 for 1 GHz

Crusoe™ PROCESSOR

Transmeta CORPORATION

QUALITY MANAGEMENT SYSTEM
CERTIFIED BY DNV
ISO 9001:2000

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efficēon PROCESSOR

Transmeta CORPORATION

Product Sheet

Transmeta™ Efficeon™ TM8300 Processor

The Transmeta Efficeon TM8300 processor is designed to address the ever-growing demand for x86 processing in value driven and energy conscious systems. Based upon a highly energy efficient design, the Efficeon TM8300 processor supports Transmeta's LongRun power and thermal management technology and fully integrated Northbridge functionality. The I/O interfaces built into the Efficeon processor's integrated Northbridge are matched with its high performance core, featuring support for DDR-400 memory, a 1.6 GB/s HyperTransport™ interconnect, and an AGP 4X graphics interface.

With the new Code Morphing Software for the Efficeon processor, Transmeta extends its leadership in power management, offering a solution that provides high performance while consuming less power for the same work. To maximize performance and responsiveness, the Efficeon TM8300 processor is based upon the same architecture and feature of the Efficeon TM8600 processor. Featuring a 256-bit wide VLIW engine that can execute up to 8 instructions per clock cycle, a 512KB L2 cache, and support for SSE & SSE2 instructions, the Efficeon TM8300 processor provides for a rich and compelling multimedia experience.

The result is a highly efficient x86 solution suitable for advanced web tablets, point of sale terminals (POS), high-end thin clients, notebooks and many other applications where an integrated, low power x86 processor is desirable.

HIGHLY INTEGRATED ARCHITECTURE

Fully Integrated Northbridge Core Logic

- On-chip DDR-400 memory interface
- Integrated AGP 2.0 compliant graphics interface for industry standard, high performance graphics solutions at 1X, 2X & 4X data rates
- On-chip 400 MHz HyperTransport™ interface, 8-bits wide in each direction, provides 12x the I/O throughput compared to 32-bit, 33 MHz PCI.
- Full support for ECC in L2 cache and northbridge memory controller enables expansion into the server market.

Enables Small Form Factor Designs

- Northbridge integration reduces system chip count, power consumption and PCB size

ENERGY EFFICIENT DESIGN

Enhanced LongRun™ Dynamic Power Management

- Enables longer battery life by dynamically adjusting operating frequency and voltage to match the performance requirements of application workloads
- Provides higher performance within smaller, thermally constrained environments

Enhanced LongRun Thermal Management

- Maximizes performance within a thermal envelope
- Low thermal characteristics enable fanless designs for quieter and more reliable systems

HIGH PERFORMANCE

8 Instruction Issue, 256-Bit VLIW Engine

- Fully Pentium 4-ISA compatible
- Up to eight instructions issued per clock cycle
- Up to 50% improvement in integer applications
- SSE and SSE2 multimedia extensions enables multimedia applications to run up to 80% faster per clock cycle than previous generation processors from Transmeta
- 512KB L2 cache improves processor performance

Advanced Code Morphing Software

- Improves performance and responsiveness over 1st generation Transmeta Crusoe technology
- Unique software based architecture is key to reducing power consumption and enabling future scalability and flexibility
- New generation Code Morphing Software technology leverages 256-bit VLIW hardware advances
- Enables quick, low cost improvements to performance and power

Transmeta Efficeon Processor Core

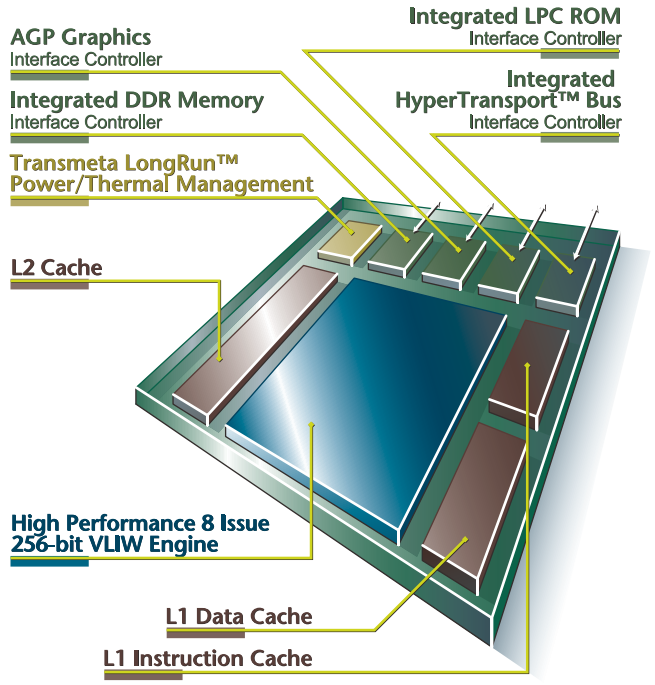
At the heart of the Transmeta Efficeon processor is a state-of-the-art VLIW (Very Long Instruction Word) hardware engine that uses a custom, efficient VLIW instruction set. Running on the processor is Transmeta's proprietary Code Morphing Software (CMS), the Efficeon software component that dynamically optimizes and translates x86 instructions into VLIW native code. This unique combination of hardware and software allows the processor to be more efficient, and also adds intelligence to Efficeon not found in other x86 microprocessors to manage power consumption and heat.

Transmeta Enhanced LongRun Power Management

Unlike conventional x86 processors, Transmeta's proprietary Enhanced LongRun power management technology is part of the Efficeon processor's Code Morphing Software. This combination allows the Efficeon processor to seamlessly adjust its operating frequency and voltage up to hundreds of times per second — dramatically extending battery life, limiting heat dissipation yet providing rapid system responsiveness.

Transmeta™ Efficeon™ Processor

Block Diagram



Smallest Solution Footprint

	Component	Package
CPU	Efficeon	841mm²
Northbridge	(included)	
	Total	841mm²
CPU	Pentium-M	1232mm²
Northbridge	855PM	1406mm²
	Total	2638mm²

Efficeon is less than 1/3 the size of Pentium-M and 855PM

Source: *http://www.intel.com — Intel® Pentium® M Processor Datasheet, June 2003; Intel® 855PM Chipset Memory Controller Hub (MCH) DDR 200/266 MHz Datasheet, March 2003*

Quarter used to show relative size.

Transmeta Efficeon TM8300 Processor

Specifications	
On-die L1 Instruction Cache	128KB
On-die L1 Data Cache	64KB
On-die L2 Write-Back Cache	512KB
HyperTransport System Bus Speed	800 Megatransfers/s
Aggregate HyperTransport Link Bandwidth	1.6 GB/s
MMX, SSE, SSE2 Instruction Support	Yes
Fully Integrated Northbridge Functionality	Yes
Integrated AGP 1X, 2X, and 4X graphics interface	Yes
Support for DDR-266, 333, 400 memory	Yes
Support for ECC memory	Yes
Integrated Low Pin Count Bus (LPC)	Yes
Full x86 Software and OS Compatibility	Yes
Enhanced LongRun Thermal Management	Yes
Enhanced LongRun Power Management	Yes
Package Size	29mm x 29mm

For more information, visit **www.transmeta.com**

efficēon™ PROCESSOR

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QUALITY MANAGEMENT SYSTEM
CERTIFIED BY DNV
ISO 9001:2000

Partners

"Modular Computers are one of the critical technologies that will define the personal computer market. For several years, we have been conducting surveys with IT buyers and consumers and found that a majority were dissatisfied with existing personal computing choices and favored the idea of a modular computer. Given this information, we expect that the modular approach to personal computing will transform the industry as we know it."

- Rob Enderle, principle analyst, Enderle Group

http://investor.transmeta.com/news/20031118-122940.cfm

MODULAR COMPUTING CORE

The MCC or "Modular Computing Core" is a standard computer, extremely small in size, which enables the user's traditional desktop applications to be carried and usable, anytime and anywhere.

Based on one's preferences and work environment, additional accessories are available for individual needs.

Transmeta's Crusoe TM5800 processor, 10 GB hard disk and 256 MB Ram are incorporated into the Core, which is 13 cm x 7.4 cm. Low power consumption makes it ideal for portable applications and no fan is required. It will automatically identify and adapt its system, power management, thermal, software and user interface behaviour depending on the attached accessory.

It can be used to run WindowsXP in multiple configurations – desktop, handheld or wearable. Users are offered a stable platform and long product lifecycles to reduce total cost of ownership. By separating the Core from the shell, the MCC can be upgraded separately over time further increasing Return On Investment.

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Fax : 41 12 742 144

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Suite 1200
Denver, CO 80129 - USA
Office : 720-344-4313
Fax : 303-200-7005

Modular Computing Core : Part Number FG-CO-001-A

The most advanced mobile handheld computing device available on the market. Capable of powering a broad range of mobile, fixed location, industrial and non - traditional computing experiences. Perfect for the individual needing anytime, anywhere access to all desktop computing applications.

- Highly power efficient Transmeta Crusoe Processor at 1 GHz using the LongRun™ advanced power management technology
- 256 MB of DDR - SDRAM Main Memory
- 10 GB (or optional 15 GB) Hard Drive with a shock rating of 200g operational and 1,000g non-operational
- Silicon Motion 722 2D / 3D Graphics supporting analog and LVDS displays at 1280 x 1024 maximum resolution
- Audio : Sound Blaster Compatible, 20bit DAC, supporting Microphone In, Stereo Out, Line Out.
- Dense 160 pin docking connector
- Windows XP Pro (or other optional standard operating systems as required)
- Plug and play compatibility

Modular Computing Rugged Handheld : Part Number FG-HH-001-A

The first Windows XP desktop-class modular computer for individuals needing Windows XP power in a highly mobile environment. Capable of withstanding significant shock and adverse conditions, this device can literally put any desktop application into the hands of any user nearly anywhere they need to work.

- Rugged industrial design, high impact plastic
  Touch screen : Analog resistive touchscreen with 6.3" 1024 x 768 TFT, backlit.
- Brightness 150 cd / m2, Contrast 100:1 min/250 : 1 typical, 202 DPI
- 2 USB v 1.1
  3.5mm Stereo Out, 3.5mm Microphone In
- VGA out, standard 15 pin
- PC Card (PCMCIA) slot, Type II
- Integrated speaker, weather resistant
- Included switching power supply, 100 – 240v AC input (supplied with handheld)
- Batteries : 10.8V 2100 mAh (approximately 3 hours)
- Buttons : CTRL - ALT - DEL, Left / Right mouse, On / Off

Modular Computing Desktop Dock : Part Number FG-DC-001-A

The MCP Desktop Dock enables the Modular Computing Core to power a full desktop environment when the user is at a desk. It has all the typical ports required to support a desktop environment, including monitor, keyboard, mouse, PC Card, audio, etc. The user need not be constrained by the small form factor of a handheld device and can work for extended periods of time in the high productivity desktop environment.

- PC Card (PCMCIA) slot for any variety of Windows XP certified expansion cards
- 3x USB 1.1 ports
- 3.5mm Stereo Out, 3.5mm Microphone In
- VGA out, standard 15 pin
- PC Card (PCMCIA) slot, Type II
- Included switching power supply, 100 – 240v AC input (supplied with handheld)

Optional Accessories

By basing the system on Windows XP™, users can leverage a broad range of 3rd party tools, accessories, and software tools with the Module Computing Platform. Antelope Technologies provides strategic tools to enable the Platform to be used in key line - of - business scenarios. These include the following:

- Detachable Keyboard for the MCP Rugged Handheld (available 2004)
  Wearable Rugged Portable Printer
- Barcode scanner
- Head Mounted Display
- Keyboard
- Mouse
- External Monitor

shift

"Using Transmeta processors has allowed Vulcan to drive innovation in the UPC category," said John O'Halloran of Vulcan Inc. "With these recent advancements users no longer will need to compromise between portability and functionality."

About Vulcan Inc.

Vulcan Inc. creates and advances a variety of world-class endeavors and high-impact initiatives that change and improve the way people live, learn, do business and experience the world. Founded in 1986 by investor and philanthropist Paul G. Allen, and under the direction of president and CEO Jody Patton, Vulcan oversees various business and charitable projects including real estate holdings, investments in more than 50 companies, from Charter Communications, DreamWorks SKG and Digeo Broadband to the Sporting News, the Seattle Seahawks NFL and Portland Trail Blazers NBA franchises, First & Goal Inc., Vulcan Productions, the Seattle Cinerama theatre, Experience Music Project and the six Paul G. Allen Foundations. For more information about Vulcan, visit www.vulcan.com

VULCAN.COM

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Seattle, WA 98104

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342 3000 Fax

CORNICE™
Take It With You

1.5GB Storage Element™

Storage Element Enables New Generation of Pocket-able Consumer Electronics Devices

The Cornice Storage Element (SE) is a patent-pending, high-capacity, low-cost, durable, dynamic storage solution capacious enough to hold 30 CDs worth of MP3 music, two hours of VHS-quality MPEG digital video, 80 video games instead of one on a handheld player, or 136 four-megapixel very-high-quality digital camera images, yet small enough to fit inside a device consumers slip into their pockets.

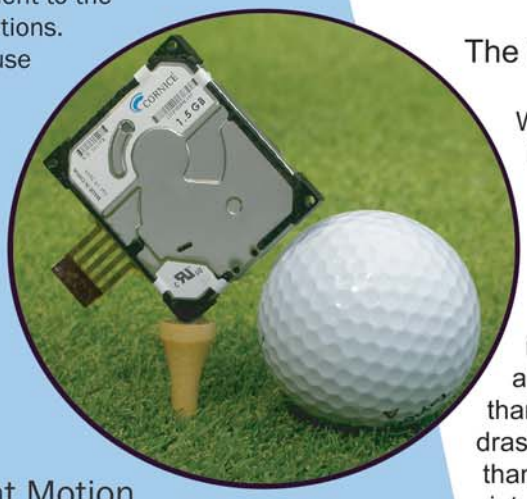
Big on the inside, small on the outside, the Cornice SE is priced to allow leading consumer electronics (CE) manufacturers to drive the retail prices of their sophisticated new mobile CE products downward toward mass affordability.

The Cornice SE is already embedded inside a new generation of high-capacity, moderately-priced, mobile digital audio and video consumer products from global brands.

The Cornice SE delivers, with proper integration, the speed and capacity of small disk drives, the low battery usage of solid-state storage media, and durability that withstands a one-meter drop onto bare concrete - all at the lowest cost in the industry.

Low Cost Many CE devices, like PCs, are bloated with redundant technology such as ROM, RAM, controllers, and microprocessors. The Cornice SE eliminates redundant technologies and unnecessary controllers, moving some functions from the storage device to the host device. As a result, CE products with the Cornice SE embedded function have far fewer total components for a lower total system cost.

Durability Embedded in digital CE devices, the Cornice SE withstands being dropped from a height of one meter onto a hard surface. The SE floats within its host device on mounts that reduce impact to the Storage Element to less than what the host device experiences. Shock is distributed and absorbed by the product enclosure. The synergistic electronics linking the host device to the SE instruct the host to sense shock and limit device access to the Storage Element to the most benign physical conditions. Finally, Cornice SE makes use of the host's DRAM to assure minimal utilization. The vast majority of the time, the SE's critical components remain in a safe and secure position.



The Cornice SE Technology Difference

While some storage solutions for portable CE products are complex, miniaturized PC hard disk drives, and others solutions such as Flash are expensive, the Cornice SE, with the lowest cost-to-capacity ratio of any storage solution, is the result of a fundamental simplification by some of the leading thinkers in the field of HDD electronics and mechanical architecture. Its design has radically fewer parts than competing solutions, for reduced cost and drastically reduced size. The Cornice SE has fewer than 40 electrical components and three integrated circuits, compared to the 110 components and six integrated circuits in competitive storage solutions.

Specifications

Jog Profile: Constant Motion
Drop Profile: 1 meter onto hard surface
Physical Size: 5mm x 42.8mm x 36.4mm
Weight: 14.6 grams
Media Transfer Rate: >4MB/S
Non-Operating Current: <100µA
Temperature: -10° to 65° C

For More Information:
303.651.7291
sales@corniceco.com
www.corniceco.com

iMagic Software

RECOGNIZING PEOPLE BY THE WAY THEY TYPE

> ***"iMagic's new technology for identifying people by touch is one of the most compelling to look forward to in decades to come."***
>
> **Rob Enderle**
> Research Fellow, Giga Information Group, December 2002

Evolution -- systems evolve rapidly; security tries to keep pace; one thing remains the same …

One of the most problematic issues in today's premiere enterprise class information technology networks is secure access. Knowing that the individuals who access and manipulate information are the ones who are authorized to do so. In most cases today the enterprise is far from secure in that knowledge, let alone practice. Systems have evolved much faster than their security capabilities.

- *Eighty percent of enterprise IT resources are access protected by nothing more than username and password.*
- *Eighteen percent of a company's user passwords can be deciphered in as little as ten minutes; fifty percent compromised within twenty four hours.*

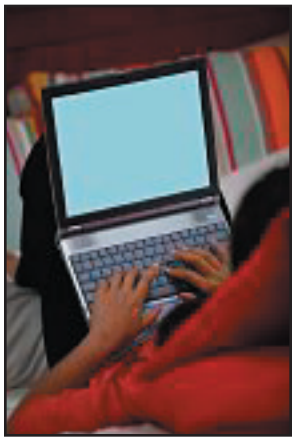
iMagic Software is delivering enterprise-class security products based upon patent-pending technology that accurately identifies users by a unique human trait – how they type. iMagic solves the problem of systems vulnerability that occurs when user sign-on and remote access authentication depend on vulnerable and insecure passwords. In a simple to use product, called Trustable Passwords™ that seamlessly integrates with existing systems and security measures to guarantee that the user who enters the password is the one who owns it.

The company was founded with the goal of bringing a new kind of authentication mechanism to the enterprise market. One with the strengths, familiarity and ease-of-use of traditional methods that can keep pace with the evolving technologies and requirements of today's diverse digital world. Trustable Passwords™ is the first in a series of digital environment security products for the enterprise that recognize users based on the way they type, using any standard computer keyboard or keypad device, including the telephone and cell phone. Trustable Passwords creates and recognizes sophisticated "keystroke signatures" that are unique to each individual, and which cannot be borrowed, lost or stolen.

Integration – systems evolve; security needs to integrate transparently…

Trustable Passwords integrates with existing sign-on and password-based authentication solutions seamlessly to provide an enhanced layer of security that reduces implementation costs, and makes existing usernames and passwords guarantee positive authorized user identity. By allowing only uniquely identified and validated users into your system, Trustable Passwords establishes a bullet proof mechanism for determining and preventing any unauthorized user access. It can provide levels of security previously associated only with very exotic, expensive and difficult to use systems – without the cost, complexity or hassles for users or administrators.

Much of the difficulty and expense of additional security measures would be eliminated if IT administrators were confident that they could in fact trust user names and passwords to safely identify the actual authorized user. When integrated with standard password validation measures provided by most systems and applications software, Trustable Passwords fully certifies the user's authenticity in a manner that is highly accurate but transparent to both system administration and user sign-on practices, local or remote.



Precision – systems evolve; so do intruders; security needs to be smarter…

Guessing whether or not your system is as secure as it needs to be is the question. Precise knowledge of user authenticity via Trustable Passwords is the answer. After a brief enrollment process, during which the system determines the user's unique and reliable key stroke rhythm pattern via a sophisticated, patent pending process (with or without the user's actual knowledge), Trustable

Passwords generates a user profile and certificate of authenticity. This can be done by average users in from two to ten minutes.

The user-to-system learning process is called structured enrollment, and is both easy to do and fun for users to implement. The certificates generated by the enrollment process can be utilized by the sign-on functions of any system or application configured for Trustable Passwords access control, guaranteeing a high degree of confidence in authorized user identification with a precision that surpasses existing capabilities at a fraction of the cost.

Users are aware only that they are recognized via their unique signature data entry style. Unauthorized users soon become aware that despite having a legitimate username and passphrase, they cannot gain access. Administrators and IT directors find that their systems are secured beyond anything they previously believed possible, or economically feasible.

Trustable Passwords Provides …

The highest degree of validated authentication for each certified user based upon their unique digital key stroke signature, with no native system modifications or hidden implementation costs.

- Fast time to deploy and enroll users.
- Lowest possible cost per user for highly reliable access security that maintains the highest degree of flexibility and transparency possible with a guaranteed secure solution.
- An easy-to-use and invisible means of making password compromise harmless.

iMagic Software Trustable Passwords Product Suite …

- Trustable Passwords Server
  - o implements and maintains the structured enrollment process and all approved user authentication profiles and certificates.
  - o integrates with the enterprise's existing system software and user access/ directory management functions.
- Trustable Passwords Client
  - o Decodes user key stroke pattern during sign-on, encrypts and sends to TP Server
  - o Integrates with all computer sign-on procedures, transparent to the user.

Trustable Passwords – "Test Drive" Program …

- Try the Trustable Passwords solution via an easy-to-use, web-based trial system implemented and administered by iMagic.
  - o Qualified enterprises designate a group of users to test the system by providing log-in samples via the web to the iMagic TP Server.
  - o Users develop a Trustable Password using the structured enrollment process, accessed via the web with no local software installation.
  - o Once a certificate is issued, users can perform test logons, verify that the system recognizes them and that it can discriminate against an unauthorized user.
- Concept proven, now your system needs advanced security like this.
- Call today for the key to your test drive, and get started with the only access security products that pay dividends in cost and complexity reduction while protecting your network like never before.

Evolve, integrate and gain a new measure of precision in secure enterprise systems access with iMagic Software's Trustable Passwords.

iMagic Software

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ENABLING A NEW GENERATION OF ULTRA-PORTABLE COMPUTERS

Imagine your palm-size PC with all the same functionality as your desktop PC: it plays music, movies, and, today's hottest games. You can view pictures and store all of your valuable data. Imagine a PDA that runs Microsoft® Windows® XP and the same applications as your desktop, with the convenience of being able to carry it in your shirt pocket. Imagine surfing the Web while waiting in line at the coffee shop, or docking your PDA to your desktop for a full-size screen and keyboard. Imagine no more. This ultra-portable computer (UPC) is now a reality thanks to the NVIDIA nForce™3 Go120 media and communications processor (MCP) and its innovative design.

The new NVIDIA nForce3 Go120 MCP coupled with an NVIDIA® GeForce™ Go mobile graphics processing unit (GPU) delivers the smallest form factor design for the latest UPCs, without compromising full PC functionality. This unique architecture enables innovative form factors and low system power consumption, powering a desktop PC experience in the palm of your hand.

COMPLETE MEDIA AND COMMUNICATIONS FEATURE SET

The NVIDIA nForce3 Go120 brings together all the features required to deliver the power and functionality of a full-fledged PC into a product small enough to fit in your pocket. This is done by incorporating the latest technologies found in today's desktop PCs and architecting these to fit into an ultra-portable form factor. Support for a combination of industry standards as well as NVIDIA-crafted technologies make this possible.

- NVIDIA StreamThru™ technology for superior networking and broadband communications
- Advanced storage technology providing for efficient storage of media and other data files
- USB 2.0 support for a standard plug-and-play interface with external devices
- Support for multi-channel audio via the AC '97 2.1 compliance interface
- HyperTransport™ low-power memory interface which maximizes application performance

These and other leading innovations combine to deliver media-rich content and applications for UPCs.

SMALLEST FOOTPRINT AND HIGHEST PERFORMANCE

The single-chip, full-featured NVIDIA nForce3 Go120 MCP is an extremely compact solution (the size of a quarter), designed specifically for ultra-portable computers.

The NVIDIA nForce3 MCP is architected to optimize the movement of data throughout the system. This built-in capability eliminates system bottlenecks and speeds up every-day media-rich applications to help you work and play faster. By evolving beyond traditional PC chipset designs, the NVIDIA nForce3 Go120 MCP single-chip solution offers improved reliability, speed, and overall performance for all computing environments.

INDUSTRY LEADING LOW-POWER SOLUTION

The NVIDIA nForce3 Go120 MCP uses innovative power management technologies to maintain system performance and long battery life. A host of power-saving features enable the highest performance while maintaining system power budgets:

- ACPI 2.0b compliance enables efficient operating system (OS) power/performance management of PC devices
- Dynamic frequency scaling and interface performance scaling deliver the power/performance balance to meet specific application requirements
- Different voltage levels of operation allow for direct power reduction and savings
- NVIDIA PowerMizer™ dynamic power-modulation technology allows users to adjust system performance and battery consumption for their specific needs

These features enable the lowest system power consumption and the longest battery life on UPCs.

ENABLES NVIDIA GEFORCE GRAPHICS PERFORMANCE

The NVIDIA nForce3 Go120 is the industry's first MCP enabling high-performance AGP graphics on these low-power UPCs, thus delivering true-to-life digital entertainment experiences and uncompromised performance through a number of architectural advances.

NVIDIA mobile AGP package (MAP) solutions deliver the power of AGP graphics cards to smaller form factors. The advanced designs of the NVIDIA nForce3 Go120 MCP and GeForce Go GPUs power a fully functional, feature-rich, and uncompromised Windows XP experience in the palm of your hand.

The NVIDIA nForce3 Go120 MCP brings a new level of PC power to ultra-portable computing. When paired with an NVIDIA GeForce Go GPU, this combination delivers a fast, efficient, and robust digital media experience—without sacrificing features, affordability, compatibility, or future upgradeability. UPCs powered by the NVIDIA nForce3 Go120 deliver the capabilities of a desktop or notebook PC in the convenience of a handheld device.

ROCK-SOLID SOFTWARE

The NVIDIA ForceWare™ software suite is the perfect complement to the NVIDIA nForce3 MCPs. Through the NVIDIA Unified Driver Architecture (UDA), a single driver simplifies software updates and lowers total cost of ownership. Continual performance and feature upgrades ensure the longevity of NVIDIA nForce-based systems. The NVIDIA System Utility, also part of ForceWare software, puts users in control of their PC resources through easy to use wizards, including controls for audio setup and system settings.

NVIDIA NFORCE3 GO120 SPECIFICATIONS

SINGLE CHIP SOLUTION
- 22mm x 22mm Full Ball Grid Array (FBGA) package
- Simplifies board layout and maximizes real-estate efficiency

POWER MANAGEMENT
- Full support for Transmeta LongRun™ technology
- ACPI 2.0 compliant
  - Support for ACPI C3 and C4 state
- Support for dynamic frequency scaling
- Ability to run at different core voltage levels
- Low power 0.15 micron process

NVIDIA NETWORKING TECHNOLOGY
- Integrated 10/100 Mbps IEEE 802.3 compliant NVIDIA MAC
- Hardware-based support for unicast, multicast, and broadcast addresses
- Wake-on-LAN support
- Auto-negotiation "plus"
- Traffic prioritization/VLAN tagging, IEEE 802.1p/Q
- Alert Standard Format (ASF) compatible
- Pre-boot Execution Environment (PXE, network boot)

FAST ULTRA ATA-133 DISK DRIVE CONTROLLERS
- Each interface supports two devices, for a total of four devices
- Supports UltraDMA modes 6-0 (UltraDMA 33/66/100/133)
- Industry-standard PCI bus master IDE register set

AGP INTERFACE
- Supports AGP 2.0 1.5V signaling for 4X, 2X, and 1X modes with 4X and 2X Fast Writes data transfers
- Supports graphics address remapping table (GART) features

HYPERTRANSPORT TECHNOLOGY
- High throughput (1.6GB/sec.)
- Low voltage
- Differential signaling
- Low pin count interface
- Isochronous link between the NVIDIA nForce3 MCP and the CPU

USB 2.0
- Single USB 2.0 Enhanced Host Controller Interface (EHCI)/Dual USB 1.1 Open Host Controller Interface (OHCI)
- Support for up to 6 ports
- Supports transfer rates at high speed (480 Mbps), full speed (12 Mbps), and low speed (1.2 Mbps)
- Dynamically configures slower devices for best utilization of bandwidth
- Allows USB concurrency

AC '97 2.1 COMPLIANT INTERFACE
- Supports 2, 4, or 6-channel audio
- Dual AC-Link supports up to two codecs
- 16-bit or 20-bit stereo output and 16-bit input streams
- Supports input, output, and GPIO channels for host-based modems
- Separate independent functions for audio and modem
- Supports ACR and CNR interface
- S/PDIF output (stereo or AC-3 output)

PCI INTERFACE
- Integrates a fast PCI-to-PCI bridge running at 33MHz. It includes an arbiter that supports six external master PCI devices. Features of the PCI interface include:
  - PCI 2.3-compliant, 5V tolerant
  - PCI master and slave interfaces
  - Supports both master-initiated and slave-initiated terminations
  - Bi-directional write posting support for concurrency
  - Flexible routing of all four PCI interrupts
  - Supports read ahead: memory read line (MRL) and memory read multiple (MRM)

CLOCK SYNTHESIZER
- Integrates a clock synthesizer
- Spread spectrum support

NVIDIA Corporation | 2701 San Tomas Expressway | Santa Clara, CA 95050 | T 408.486.2000 | F 408.486.2200 | **www.nvidia.com**

Company Fact Sheet

About Pen&Internet

Pen&Internet, LLC, a division of Parascript, LLC, provides advanced electronic ink, recognition and communications technologies, products and services for mobile, pen-enabled computers and devices. Headquartered in Sunnyvale, CA, the Pen&Internet team has advanced engineering and R&D teams with over 80 years combined experience in these technologies.

Pen&Internet Products and Services:

riteForm™ — An advanced recognition solution for processing handwritten forms on mobile, pen-enabled devices.

riteMail® — A unified note taking application and an interactive, multi-platform handwritten email service. Base list: $14.95 to $44.95.

ritePen™ — An advanced handwriting recognition and pen utility that improves the core UI functionality and handwriting recognition for the Tablet PC and other Windows-based pen computers and desktops. Base list price is $19.95. A **riteNotes™** bundle with ritePen and riteMail is $29.95.

Pen&Internet Technologies

Pen&Internet has a complete electronic ink and recognition technology portfolio that includes handwriting, shape and chart recognition; ink collection and rendering; communications and compression technologies.

Pen&Internet Partners

Pen&Internet currently partners with leading OEMs and system integrators, including Transmeta, Antelope Technologies, HP, Anoto, Seiko Instruments, Sun, Teleca, Wacom, FingerSystem, Clevo Computer Company, TDV Vison, Sager, Eurocom, Pioneer Computing, dopod Communication Corp., The Newman Group, Raco Wireless, and many more.

Pen&Internet Business Highlights:

- Transmeta is a partner for the Ultra Personal Computer (UPC) platform
- Antelope Technologies has bundled ritePen and enables riteForm with every Modular Computer Core (MCC)
- HP has integrated riteForm with its new Forms Automation System (FAS)
- Dozens of system integrators are evaluating riteForm; pilot projects with key system integrators are underway
- Anoto is a forms processing partner for its digital pen & paper technology
- Clevo has bundled riteNotes with every T200V pen laptop, distributed by 10+ OEMs
- FingerSystem has bundled riteNotes with every i-pen mouse sold in the U.S.
- dopod has bundled riteMail with every dopod 696 convergent Pocket PC phone
- Seiko Instruments is a worldwide partner for riteMail on the Seiko InkLink platform

Funding

Pen&Internet, LLC, is a division of the privately held company Parascript, LLC.

Corporate Officers

Leonid Kitainik, General Manager, Pen&Internet; Jeff Gilb, President & CEO, Parascript

History Overview

The Pen&Internet team began developing early versions of natural handwriting recognition and ink compression technologies at ParaGraph in 1989. While at ParaGraph, they licensed handwriting recognition technologies to Apple for its Newton PDA, as well as ParaGraph technologies and applications to 40+ companies, with a cumulative user base of more than one million. CalliGrapher handwriting recognition technology, developed by the team, is currently part of the Pocket PC, Office XP and the Tablet PC. In 2000, the team moved on to Parascript, forming the Pen&Internet division.

ritePen™

the *rite* connection, the *rite* tools™

Experience next-generation handwriting recognition

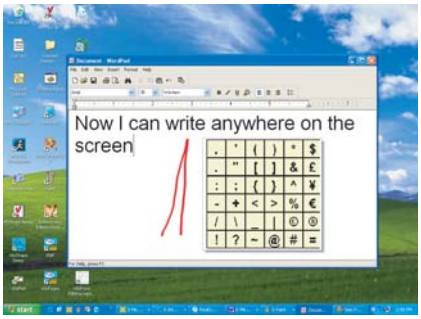
- Full screen writing
- Seamless pen navigation

Introducing ritePen™, an advanced handwriting recognition and pen navigation tool for the Tablet PC and other Windows-based computers. ritePen lets you write on the full screen in smooth electronic ink and instantly converts natural handwriting into text in any Windows application.

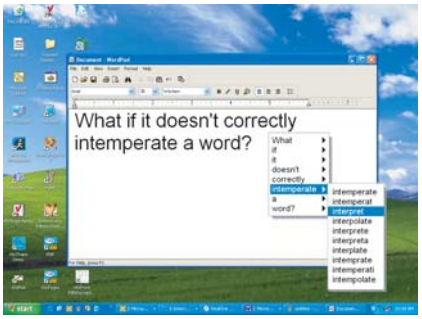
"How many times have we heard promises about handwriting recognition that really works? This time it does."
- San Jose Mercury News

Features

- **High recognition accuracy:** riteScript™ handwriting recognition engine provides highly accurate and unrestricted handwriting recognition.
- **Improved recognition on the Tablet PC:** On the Tablet PC, ritePen achieves much better recognition (20% fewer errors) than the embedded recognition software.
- **Instant text input:** Allows instant and transparent input of recognized text into any Windows application.
- **Full screen writing:** You aren't limited to a dedicated handwriting input area; writing can be done anywhere on the tablet screen.
- **High-quality electronic ink:** Offers a superior quality of electronic ink for smooth writing in a variety of colors.



You can easily call up a symbol table just where you're writing



You can always invoke a drop-down answer list of the most recent handwritten text

- **Natural editing gestures:** Comes with intuitive, easy-to-learn and reliably recognized gestures for basic editing operations.
- **Seamless pen navigation/manipulation:** Provides instant, intelligent identification and pen manipulation of pull-down menus, scroll bars, toolbars, control elements, and input areas.
- **Alternative answers listed:** With a simple gesture, you can invoke pop-up lists of handwriting recognition alternatives for every word in a phrase, boosting recognition accuracy.
- **Custom user dictionary:** You can add your own words to the default vocabulary to further improve recognition accuracy.

Specifications

- **Language:** Currently available for the recognition of English and German languages
- **Input device:** Pen laptops, Tablet PCs, electronic pens, screen and graphics tablets, touchscreens, etc.
- **CPU:** Pentium class CPU 500 MHz or higher on Windows computers
- **Memory:** 64MB RAM or more
- **Monitor:** SVGA (800x600) or better
- **Disk space:** 8MB
- **Platform:** Windows 98/2000/XP/ XP Tablet PC Edition

pen&internet™

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tel: 408.746.9900
fax: 408.746.9901

www.penandinternet.com
info@penandinternet.com

riteMail®

the *rite* connection, the *rite* tools™

Unified Note Taking has finally arrived with riteMail® 2.0

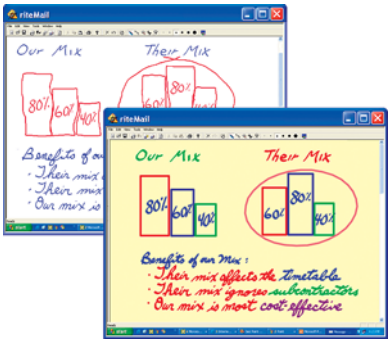
◆ **Write high-res handwritten notes and drawings from anywhere**

◆ **Send them to any email address**

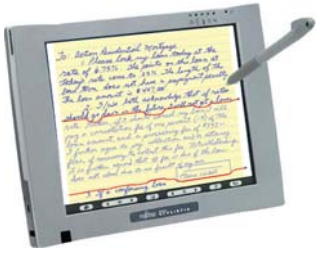
◆ **Fully edit and recognize text, shapes and charts on your desktop**

Features:

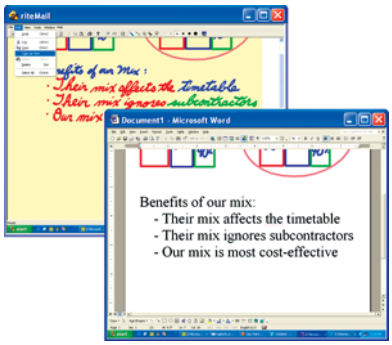
- Unified Note Taking on mobile and other pen-enabled computers and devices - combines electronic ink capture with deferred processing and notes recognition across multiple platforms
- Easy user interface requires no learning or training
- Continuous writing space and high quality electronic ink available in various pen styles, a full range of colors, and six different line widths



- Unique riteShape™ technology that instantly perfects common shapes and complete charts. riteShape intelligently adjusts, aligns, resizes, corrects gridlines, connects arrows and adjacent shapes, and fine-tunes concentric shapes
- Advanced editing of handwritten notes on your desktop, including the ability to move, copy, delete, resize, and change the color, width, and style of any portion of your notes



- Next-generation riteScript™ handwriting recognition that copies recognized text to the Clipboard for pasting into other applications
- Effortless exporting of electronic ink into key office applications



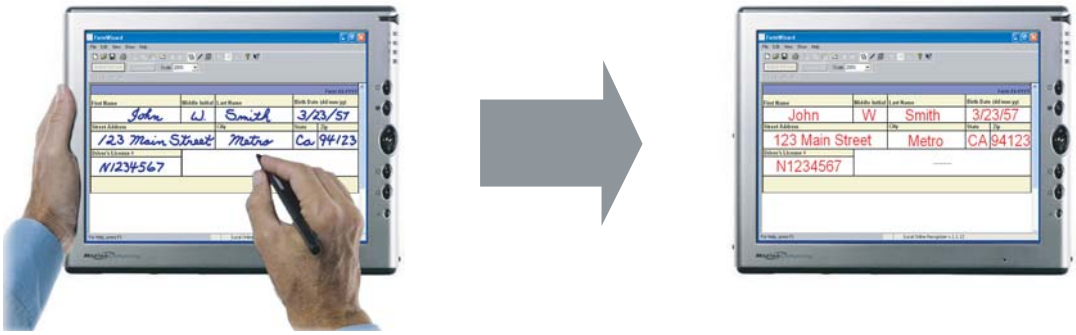
- Smart printing of electronic ink on desktops, laptops, and Tablet PCs with intelligent page-break adjustment
- Seamless integration with all popular corporate and personal email systems; condensed, bandwidth-friendly notes sent through any SMTP server and received via POP3 or IMAP4 protocols
- Currently available for Windows 98/2000/XP/XP Tablet PC Edition, Palm OS, Pocket PC, Windows CE 3.0, and any Java-enabled desktop

pen&internet™

www.ritemail.net
info@ritemail.net

riteForm™

the *rite* connection, the *rite* tools™



Advanced recognition of handwritten forms *—more powerful, more accurate*

The riteForm™ product suite provides an innovative solution for the recognition of handwritten forms. Because of its unique features, riteForm delivers unparalleled handwriting recognition accuracy.

Features

- **Next generation handwriting recognition:** riteForm utilizes the riteScript® handwriting recognition engine for highly accurate and unrestricted handwriting recognition
- **Writer and style independent:** Understands the handwritten style of any writer from the start, recognizing both vocabulary and non-vocabulary words and arbitrary combinations of letters, digits and special signs
- **Advanced lexical support:** Significantly improves on recognition of handwritten text by assigning lexical sources—including field-specific vocabularies, data templates, and combinations of both—to individual fields
- **Phrase and line aware:** Provides automatic word and line segmentation and baseline detection within form fields
- **Alternative answers listed:** Lists handwriting recognition alternatives, with their scores, for every word written in a field, further improving recognition accuracy. Confidence levels are also provided for better interpretation of results

riteForm Product Offering

Product	Description
riteForm Remote Service	riteForm Remote is operated by Pen&Internet, or customers can choose riteForm Remote Enterprise, which includes server, middleware, gateway, account management system, and reporting system
riteForm Remote SDK	Connects forms processing applications to riteForm Remote service
riteForm Local SDK	Connects forms processing applications with local (client side) riteScript engine (Optional) ritePen™ handwriting recognition application and pen utility with built-in riteScript engine
Custom Lexical Sources	The Professional Services team at Pen&Internet builds specialized lexical sources upon customer request. This team also provides integration services for riteForm Remote Enterprise.

Specifications

- **Language:** Currently available for the recognition of English-language forms
- **API's:** C/C++, Java, COM interface for Windows, C/C++ interface for Pocket PC
- **Input device:** Electronic pen & paper, Tablet PC, other screen and graphics tablets, and Pocket PC
- **CPU Requirements for Local Version:** Requires Pentium class CPU 500 MHz on Windows-based equipment
- **Installer Size:** 6.5MB for local Windows version, 1.5MB for Remote
- **Run-time Memory Footprint:** 10MB for local Windows version, 5MB for Remote
- **Client platform:** Windows 98/2000/XP and Pocket PC
- **Server platform:** Windows 2000/XP

pen&internet™

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Pumatech To Partner with Transmeta to Keep UPC-platform Devices in Sync

Pumatech, Inc. (NASDAQ: PUMA) provides organizations with a comprehensive suite of software products and services that synchronizes and distributes critical information throughout the enterprise. Pumatech's solutions effectively address the growing number of devices, access points, and data sources utilized by the typical mobile worker in today's enterprise, allowing organizations to maximize productivity while minimizing complexity. As a result, enterprises are able to optimize their existing investments, without having to add costly mobile infrastructure. With Pumatech's enterprise offerings, organizations can extend the usefulness of their devices, plug network security holes to promote safe exchange of sensitive information, and Web-/mobile-enable a variety of data sources.

Organizations can choose to use Pumatech's ready-made enterprise offerings, or they can leverage Pumatech's professional services team to create custom solutions built upon Pumatech's core enterprise platform. Pumatech's customer and strategic partner base includes Global 2000 companies such as Microsoft, Oracle, PeopleSoft, America Online, Yahoo!, NTT DoCoMo, Eastman Kodak, and IBM.

Pumatech's award-winning IntellisyncR synchronization software has a presence in more than half of the Fortune 1000; has been licensed by more than 200 software developers, device manufacturers, and online services, and enjoys 90% market share among PC-to-PDA synchronization software sold through the U.S. retail channel.

Pumatech's combined technologies have cemented its position as a leading provider of synchronization and mobile infrastructure solutions to the enterprise, technology licensing, and consumer markets. Pumatech's leadership is bolstered by an extensive intellectual property portfolio that includes 50 issued technology patents, 58 pending patents, and seven patents licensed from a third party.

Pumatech's Synchronization Technology To Benefit Transmeta's UPC Device Platform

Pumatech's award-winning Intellisync family of synchronization solutions includes technology that provides file transfer as well as file and PIM (personal information manager) synchronization between two PCs (via infrared or cabled connections), or between a PC and a network server (via mapped network drive). This Intellisync-based solution makes keeping all your information up-to-date as simple as a click of the mouse. Whether you need to synchronize files from one PC to another, replicate information from one PIM application (e.g., Outlook) to another, or back up data to a server (via a mapped network drive), your information is always safe with Pumatech.

Pumatech and Transmeta are working together to offer these powerful capabilities to users of the UPC device platform. The custom solution developed by Pumatech will assure UPC device users that they have the correct data where they want it.

To take advantage of this functionality, users simply need to choose the files or fields they wish to synchronize and let Intellisync do the rest. The solution also provides copy, move, delete, and synchronization of files and directories on a local or remote computer. Users can simply drag and drop or cut and paste from one computer to the next. But Intellisync is more than just a file transfer tool -- it overcomes disparate Windows operating systems, applications, and PCs to keep information up-to-date. The product even allows users to synchronize files only for updated contents rather than overwriting the entire file, thereby increasing the speed of the transfer and saving time.

Pumatech's solution provides a host of advanced synchronization features such as:

- Full Conflict Resolution (eliminates duplicate entries)
- Field Mapping (ensures data enters the proper fields)
- Ability to create jobs for common tasks
- Synchronization of data between different PIMs
- Ability to synchronize the same PIM application between two different machines
- Synchronization of drives and directories on two computers (or two drives or partitions on a single computer) with a click of the mouse
- Synchronization of files on two different systems
- Synchronization across platforms
- Auto Synchronization -- sync-on-connect to specified system

By offering Pumatech's advanced synchronization and file-transfer technology with its devices, Transmeta is extending the value of the UPC platform by enabling customers to stay productive wherever they happen to be.

SM722

The Low-Power Leader

- 128-Bit 2D/3D Graphics Engine
- High Integration with up to 8MB of Internal Memory
- Hardware Accelerated MPEG2/DVD Playback
- Industrial Temperature Available (-40° to +85°)
- Long Term Supply Assurance

Overview

The SM722 Mobile Display Controller features a 128-bit 2D/3D mobile graphics engine, and 4MB or 8MB of internal memory. The SM722 offers enhanced multi-display and hardware accelerated MPEG2/DVD playback all in a single footprint, Multi-Chip BGA (MCB®) product, and allows design flexibility across different application platforms.

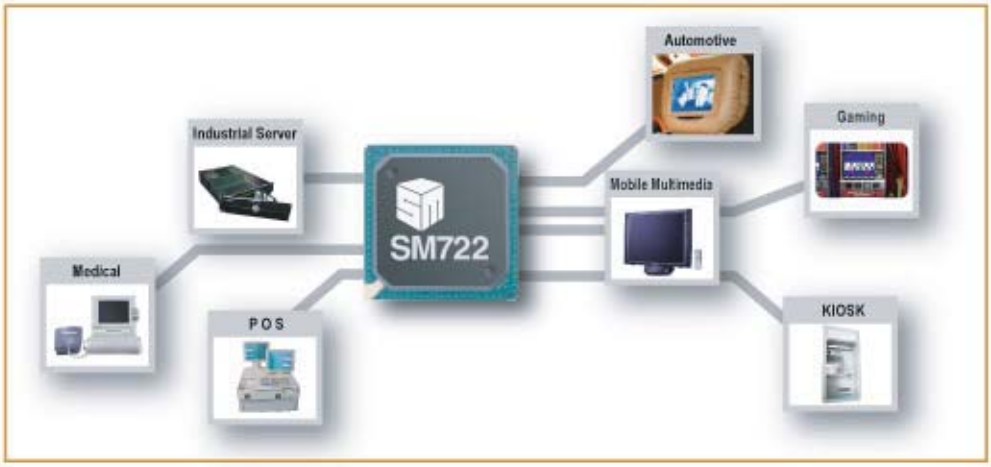
As a leading graphics and video supplier for the embedded market, Silicon Motion, supports a variety of Operating Systems, CPU's, and reference platforms. Silicon Motion also provides dedicated customer support, and a line of products that allows the best high performance, low cost solution.

Silicon Motion's ReduceOn™ technology is the intelligent power management that algorithmically varies the clock and power to functional units depending on system demand. Using the SM722 results in a dramatic reduction in average operating power consumption in your device.

The SM722 is part of the Lynx SM7XX family of products that provide the key features needed to design the next generation mobile multimedia, automotive, and embedded applications.

SM722

Lynx722 will take you into the future!



Graphics Acceleration
- 128-bit BitBLT engine
- Dual pipelit3D
- Bi-linear and tri-linear filtering

Panel Support
- Integrated LVDS transmitter
- TFT or DSTN LCD support
- Simultaneous independent displays
- Flexible support for range of panels
- Hardware Rotation (90 , 180 & 270 degrees)

Low-Power Consumption
- ReduceOn Power Management
- ACPI compliant

Product Life Cycle
- Long term availability
- Pin compatibility path to SM7XX family
- Driver stability and software support
- Patented MCB technology offers higher yields with lower cost.

Video acceleration
- Motion Compensation for full frame rate DVD playback
- Zoom Video Port
- Bi-linear scaling
- Multiple independent hardware video windows

Memory
- Up to 128-bit memory interface
- 4MB or 8MB internal memory
- Over 1.6GB/s memory bandwidth

Industry-Standard Host Bus Interface Support
- PCI 2.1
- AGP2X with sideband support

Other Features
- 316-ball BGA package
- Package 27mm x 27mm
- 3.3/5.0 volt operation
- Driver stability and software support

Software support
- Windows® 98/Me/2K/XP
- Windows® CE.net
- Linux embedded
- QNX®

For More Information

To learn more about the SM722 and Silicon Motion's low-power silicon and software solutions visit our website at www.siliconmotion.com.

Silicon Motion, Inc.

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USA
1040 E. Brokaw Road, San Jose, CA 95131-2309
Tel: (408) 501-5300 Fax: (408) 467-9390
www.siliconmotion.com

The Low-Power Leader

Key Features

- **Ultra low-power 3D/2D display controller**
- **DualMon technology for expanded view on secondary monitor**
- **QuickRotate feature for instantaneous rotation**
- **Hardware supported rotation for 90°, 180° and 270°**
- **TabView™ for extended desktop view on secondary monitor for docked TabletPC**
- **Enhanced ReduceOn™ power management**

Overview

Silicon Motion, Inc. introduces the SM731, an ultra low power, high-end 2D/3D display controller with hardware rotation. The SM731 provides an ideal solution for battery-sensitive devices such as TabletPC's, wireless broadband terminals, and web tablet platforms. The growing popularity of Wireless LAN/PAN technologies such as 802.11 and Bluetooth has created a demand for energy efficiency and longer battery life for mobile devices.

Silicon Motion's ReduceOn™ technology for the SM731 has been enhanced and functions that were previously performed in software have now been implemented in the hardware, allowing easier driver development. ReduceOn technology intelligently monitors the activity on the device and optimizes the power as necessary to maximize performance and power consumption. This level of power management is possible since each functional block and engine clock can be dynamically controlled to actively reduce the overall power consumption, thus extending the battery life of mobile platforms.

With its DualMon technology, the SM731 allows several applications to operate simultaneously across two independent display devices – all from a single chip. Silicon Motion's entire product line has the capability to perform 90°, 180° and 270° hardware rotation. The SM731 also offers a unique feature that allows TabletPC OEMs to implement a feature called TabView™. TabView allows the users to display applications on different orientations. This allows the use of the device in its natural orientation; for example, a TabletPC's LCD (portrait mode) and CRT (landscape mode).

In addition to mobile platforms, the SM731 is well suited for use in Car Information Systems, Point-of-Sale terminals, Kiosks, and various embedded applications.

SM731

Rich 3D/2D Features

- IEEE Floating point setup engine
- Bi-linear/Tri-linear filtering
- Multi-texture, bump mapping
- MIP-mapping, vertex and global fog
- Source/destination alpha blending
- Specular highlights, Z-buffering
- Dual-texture pipelines
- Texture compression
- BitBLT, line draw
- Polygon/rectangle fill
- Hardware cursor and pop-up icons

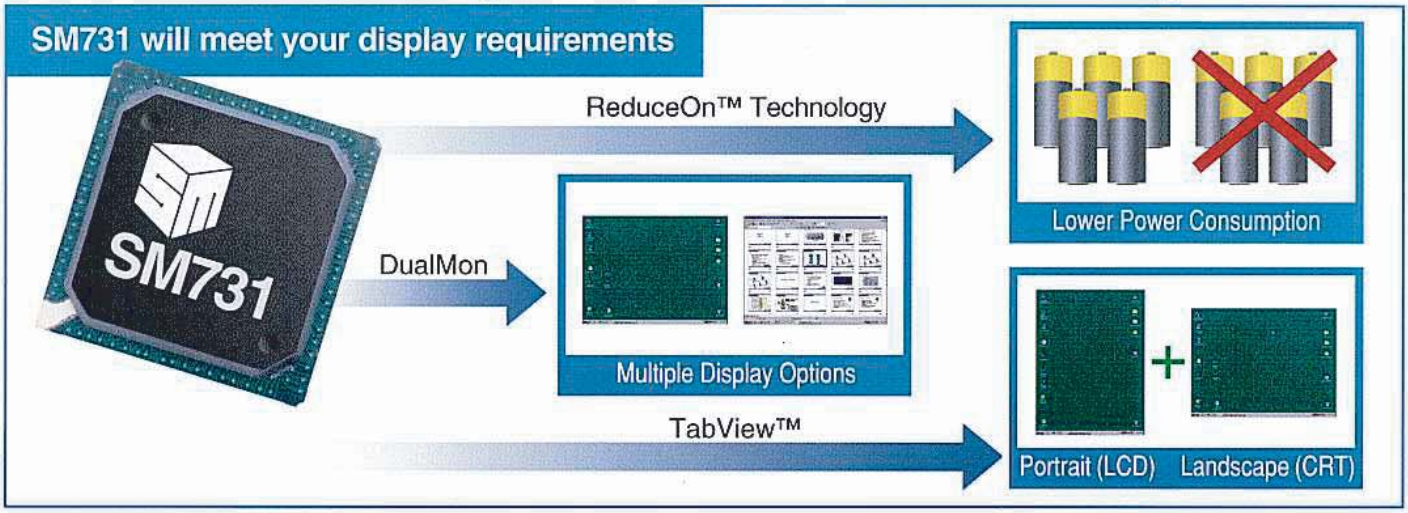
Video

- Motion comp for full-speed DVD playback
- Zoom video port
- Video filtering
- Multiple independent hardware video windows

Memory

- 64-bit memory interface
- Various on-chip DRAM memory configurations

SM731 enables expanded view on secondary monitor



Panel Support

- Integrated Dual Channel LVDS transmitters
- 18/24 bpp TFT support
- Single or dual pixel per clock
- DualMon support
- QuickRotate feature for instantaneous rotation

Power Management

- Enhanced ReduceOn™ power management
- ACPI compliant

Miscellaneous

- PCI interface
- AGP 1X, 2X, and 4X interface (3.3V or 1.5V) with sideband support
- PC2001 compliant

Software Support

- Windows®XP TabletPC Edition, Windows®XP, Windows®2000, Windows®Me, and Windows®98
- Windows Embedded: CE.net
- Other operating systems available upon request
- Multi-language control panel Applet

For More Information

To learn more about the SM731 and Silicon Motion's low-power silicon and software solutions visit our website at www.siliconmotion.com.

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Company Overview

Think Outside Inc. invents, engineers and manufactures compelling new products for mobile computing. The products are marketed and distributed worldwide by some of the leading companies in the handheld and wireless industries. By focusing on the needs of the end user, the company creates mobile solutions that take what is possible and make it practical. The ultimate goal is to enable people to use computing and communications technologies more powerfully and effectively, anywhere and anytime. And to enjoy the experience!

Company Background

Think Outside Inc. is privately held and was founded in April 1998 by a successful product inventor, Bob Olodort. Think Outside corporate headquarters are in Santa Clara, Calif., in Silicon Valley. Products are engineered in the United States and manufactured under Think Outside's direction.

Current Product Offerings

Think Outside supplies the Stowaway USB portable keyboard to Antelope, a leader in the UPC market. The keyboards are also available under the Think Outside brand as the Stowaway Keyboard, Stowaway Infrared Wireless Keyboard, and Stowaway XT Keyboard; the Kyocera Smartphone Portable Keyboard by Kyocera Wireless Corp.; the Motorola iBoard by Motorola; the Palm Portable Keyboard, Palm Wireless Keyboard and Ultra Thin Portable Keyboard by PalmOne Inc.; and the Sony Compact Keyboard by Sony. Versions are available for nearly all leading handheld devices including: Palm, Sony Clie, HP/Compaq iPAQ, Kyocera SmartPhone, Motorola iDEN mobile phones, BlackBerry 857 and 957 wireless handhelds.

Highlights of Think Outside's Success To Date

- More than 2.5 million keyboards sold in the first year of shipping and nearly 2.5 million to date, making the Stowaway keyboard the most successful new product for handheld computing
- The keyboard is included in the Design Collection of The Museum of Modern Art (MoMA) in New York
- Winner of nearly all major new product awards including Best Design for a computer product from PC Magazine and Best of Show at CES

UPC in the Media

"We see this as 'This is your only computer'. It isn't a PDA (personal digital assistant). With this device you can dock it in and it is your PC."
- Colin Hunter, executive vice president of OQO

"Another factor at play supporting handhelds is that consumers and corporate America have become acclimated to portability. The explosive growth, until recently, of handheld devices and cell phones established the market for portable devices."
- Michael Kanellos, CNET

"Despite the faster chip, the batteries on the OQO run about 9.5 hours. Although the Crusoe processor runs on fairly low amounts of energy, the small screen size helps enormously."
- Dave Ditzel, vice chairman and CTO, Transmeta and
Colin Hunter, executive vice president of OQO

http://news.com.com/2100-1040-883861.html
Start-up Shrinks PC to Palm Size
CnetNews.com

UPC in the Media
UPC in the Media
UPC in the M

Transmeta CORPORATION

UPCs in the Press

And Now For Something Completely Different - The OQO Ultra-Personal Computer
AppleLinks.com - Personal Computer
Charles W. Moore
October 7, 2003
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Hand-size Windows PCs within your grasp
CnetNews.com
Michael Kanellos
October 24, 2003
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Manufacturers Try Out Tiny Tablets
CnetNews.com
John G. Spooner
April 15, 2003
http://news.com.com/2102-1005_3-996962.html?tag=st_util_print

Start-up Shrinks PC to Palm Size
CnetNews.com
Michael Kanellos
April 16, 2002
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Rob Enderle
November 6, 2003
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Arik Hesseldahl
April 29, 2002
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New "Ultra-Personal Computer" Will Run Linux (and much more)
LinuxDevices.com
No Author Listed
April 17, 2002
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Full-featured PC fits in pocket
NewScientist.com
Duncan Graham-Rowe
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http://www.newscientist.com/news/news.jsp?id=ns99994315

Antelope Technologies and Transmeta Announce the Availability of the First Product Based Upon New Modular Computing Architecture
Press Release
November 18, 2003
http://investor.transmeta.com/news/20031118-122940.cfm

Is That an OQO in Your Pocket?
NetworkWorldFusion.com
Keith Shaw
April 22, 2002
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Antelope Technologies and Transmeta Announce the Availability of the First Product Based Upon New Modular Computing Architecture

Modular Computing Core (MCC) Begins Shipping to Customers

Highlands Ranch, CO and Santa Clara, CA, November 18, 2003 – Antelope Technologies, Inc., a leader in modular computing technologies, and Transmeta Corporation (NASDAQ:TMTA), the leader in efficient computing, today announced that Antelope's Modular Computing Core (MCC) powered by the Transmeta Crusoe® processor is now shipping to customers. With the introduction of this new technology, an innovative new market segment has been created in the computer industry – Modular Computing. Architectures based upon the Modular Computing concept allow mobile professionals to combine the functionality of a PDA, desktop and notebook computer into a single portable device.

During November, Antelope Technologies will deliver its first design based upon the Modular Computing vision, the Modular Computing Core (MCC). The MCC provides full desktop computing power in a form factor that can fit in your pocket, and because of the modularity, it can be used anywhere and anytime in a broad range of computing environments. The MCC is powered by the energy efficient 1GHz Transmeta Crusoe processor and runs the powerful Microsoft® Windows® XP Professional operating system.

"Transmeta continues to show its commitment to innovation by providing processors that alter how mobile computers are used, opening up new and exciting opportunities for people to improve the way they work, communicate and ultimately live their lives," said Kenneth Geyer, president of Antelope Technologies. "The release of our Antelope Modular Computing Platform Kit allows people to choose how they utilize their data freeing them from the traditional desktop-centric model."

"Modular Computers are one of the critical technologies that will define the personal computer market," said Rob Enderle, principal analyst for the Enderle Group. "For several years, we have been conducting surveys with IT buyers and consumers and found that a majority were dissatisfied with existing personal computing choices and favored the idea of a modular computer. Given this information, we expect that the modular approach to personal computing will transform the industry as we know it."

"Imagine that your desktop computer could be converted into a handheld or hands-free computer, enabling the same data and applications you use everyday to be available anywhere – this dream is now a reality," said Arthur L. Swift, senior vice president of marketing for Transmeta. "Unlike today's PDA, Antelope's MCC eliminates

-more-

the need to sync data from one device to the next, saving countless hours in the lives of busy mobile professionals and offering a true computing experience anytime, anywhere."

The MCC measures a scant 3"x5"x3/4" and weighs approximately 9.1 ounces. The power supply, display and I/O connectors have been removed – leaving only the processor, memory, data and applications. Components removed from the MCC are arranged into different shells, allowing the device to be inserted into these shells, transforming it into a handheld computer, then a desktop computer, and back to a handheld in just seconds without rebooting or synching. By combining the functionality of a PDA, desktop and notebook computer, the modular computers eliminate the need for multiple operating systems and software licenses.

Antelope Modular Computing Core Specifications
Dimensions: 3" x 5" x 0.75"
Weight: approximately 9.1 ounces
Hard drive: 10 GB or 20 GB
RAM: 256Kb
Processor: 1GHz Transmeta Crusoe 5800
Video Adapter: 8Mb 3D graphics chipset
Operating Systems: Microsoft Windows XP Professional
Handheld Display: 6.3 inch, 1024x768, full color touch screen

About Antelope Technologies
Antelope Technologies is a Colorado corporation that designs, manufactures and markets mobile computing technologies. Based in Highlands Ranch, Colorado, the company integrates these technologies for military, medical, industrial, security and law enforcement institutions worldwide. Antelope Technologies is the only company licensed to manufacture and market the Modular Computing Core and recently opened a separate manufacturing facility in Neuchâtel, Switzerland under the name Antelope Technologies (Suisse) SA. For more information in the United States contact www.antelopetech.com or 720-344-4313 (US) and internationally at www.antelopetech.ch or 41 (0) 32-723-0366 (Switzerland).

About the Transmeta Efficeon Processor
The Transmeta Efficeon processor is designed to provide power efficiency, design flexibility, performance-on-demand and low cost to meet the need of the next generation of mobile, wireless, and embedded devices. It includes three new high performance bus interfaces: an on-chip HyperTransport™ bus interface for increased input/output efficiency, an on-chip Double Data Rate (DDR) SDRAM memory interface for increased throughput, and an on-chip AGP graphics interface for high performance graphics solutions. These new interfaces allow Efficeon to achieve more work per clock, which results in greater energy efficiency and longer battery life for mobile computer users. The Transmeta Efficeon processor's dynamic LongRun® power management features and integrated architecture are designed to give system designers and marketers a wide range of choices in creating products that deliver added value, functionality, security, comfort, reliability, and cost savings to end users.

About Transmeta Corporation
Transmeta Corporation develops and sells software-based microprocessors and develops additional hardware, software and system technologies that enable manufacturers to build highly efficient computing systems characterized by low power consumption, reduced heat dissipation and the high performance required to run standard x86 compatible programs. We originally developed our family of Crusoe microprocessors for lightweight notebook computers and other mobile computing devices, but we have developed and are continuing to develop microprocessors suitable for a variety of existing and emerging end markets in which x86 program compatibility and energy and thermal efficiency are desirable.

To learn more about Transmeta, visit www.transmeta.com.

Safe Harbor Statement

This release contains forward-looking statements made pursuant to the safe harbor provisions of the Private Securities Litigation Reform Act of 1995. Such statements speak only as of the date of this release, and we will not necessarily provide updates of our projections or other forward-looking statements. Investors are cautioned that such forward-looking statements are subject to many risks and uncertainties, and may differ materially or adversely from our actual results or future events. Important risk factors that could have material or adverse effects on our results include general economic and political conditions and specific conditions and volatility in the markets that we address, the rescheduling or cancellation of significant customer orders, market acceptance and adoption of our new products by our present and future customers and end users, difficulties in developing or manufacturing new and existing products in a timely and cost effective manner, our dependence on third parties for sourcing materials and providing manufacturing services, intense competition and competitive pressures, patents and other intellectual property rights, and other risk factors. We urge investors to review our filings with the Securities and Exchange Commission, including our most recent reports on Forms 8-K, 10-K and 10-Q, which describe these and other important risk factors that could have an adverse effect on our results. We undertake no obligation to revise or update publicly any forward-looking statement for any reason.

# # #

White Papers

"What makes concept so useful is that there no longer needs to be separation between the PC you use at the office and the one you use at home. They can be one in the same."
- Arik Hesseldahl, Forbes

http://www.forbes.com/2002/04/29/0429tentech.html
The Little Computer that Can
Forbes.com

White Papers
White Papers
White Papers
White Papers

Building a Total Economic Impact™ Framework for Modular Computing

Project Director: Jon Erickson, Sr. Industry Analyst
Contributing Analyst: Rob Enderle, Research Fellow

February 2003

Technology advice.
Business results.

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Executive Summary

The movement toward increased mobility is an inescapable fact in today's workplace environment. The growing use of laptop computers as well as wireless communication devices illustrate the change that IT must respond to both in the short and long term. As a result, organizations increasingly have to decide whether and when to support an increasing portfolio of devices that a mobile user has at their disposal. Being able to juggle the demand from end users to support these devices while at the same time justifying the increasing cost of that support is becoming a key issue more and more within IT departments that have a sizable mobile population.

With IT and PC budgets subjected to such scrutiny, the frequently asked question is: "What is the least that I can spend on PC hardware and mobile devices to provide a simple mobile platform for my users?" In response to this question, Giga Information Group and other advisory organizations publish platform recommendations that attempt to guide organizations to select the least expensive bundle of services that will meet the needs of the end user through an expected three-year life of the computer. While cost is an important driver in the decision, an equally as important question to ask becomes: "What is the value to the organization of increasing the mobility and flexibility of the end users?"

Transmeta Corporation, with it's Crusoe CPU chip, through a partnership with such organizations as Antelope and OQO, is examining the potential impact of a single ultra personal computer (UPC) device on a sample end-user population. With UPC there is the potential of having the capabilities of a laptop, personal digital assistant (PDA) and other wireless devices in a single compact device. In addition, it is anticipated that UPC gives an end user the capability of easily adding peripherals through Bluetooth and WiFi to further extend the functionality of the device. The potential, as Transmeta and organizations such as Antelope see it, is to deliver a device that has the same functionality of a laptop computer with the size and features of a PDA device.

Using Giga Information Group's Total Economic Impact™ (TEI) model, we evaluated the basic value proposition of the UPC mobile computing model in terms of cost, benefit, flexibility and risk. The objective of this report is to establish a framework for the reader through which the value statements of UPC and Transmeta can be filtered and applied to their own organization. It is important to note that the values contained within this report are based on projections around the functionality of the UPC product and have not been validated with users of the product. Therefore, this report should be seen as a guide for readers that are considering justifying the use of UPC within their own organization. Estimates contained within this report must be adjusted to reflect the actual environment.

Study Goal and Methodology

The progression of mobile PC technology forces those chartered with developing organizational life-cycle management to balance two objectives: (1) capturing a drop in price over time for a given level of system and (2) keeping the capital cost of the device somewhat static, but purchasing more technology than the average business user immediately needs. Currently, this decision is something of a "black art," with the decision-maker looking into the future to forecast the application needs and business profile two to three years in advance. System configurations are then selected to minimize cost and maximize the useful life of the system (even though future upgrades to these systems may cost more than earlier savings). Ideally, the systems will be sufficient to run the business-standard combination of systems and application software three years from the purchase date with a level of performance that will not frustrate the user, force an upgrade to any or all of the systems components or tempt the user to remove otherwise beneficial tools to increase performance or reduce interruptions as background processes are invoked.

Organizations such as Transmeta postulate that the ability to provide a compact device to a mobile user with the functionality of a laptop computer and a PDA, plus flexibility around added peripherals, can be used to reduce direct IT costs while at the same time enhancing overall organizational value. This study has as its charter the evaluation of this marketing approach and the quantification of potential costs and benefits in purchasing an ultra personal device compared to the standard configuration of a mobile user that is using either a laptop or desktop as well as a PDA device. It also seeks to objectively show the potential risks of moving forward with such an investment in light of the potential acceptance of such a device for a given organization.

Key to understanding the benefits of ultra-personal computing is the realization that it is not a static set of products or technologies but rather a shifting set that maximize the value of a given mobile end user. The ultra-personal device is simply a platform with which applications and other products can be added to maximize the functionality and flexibility of the given work environment. Over time, features and technologies that were only available as third-party add-on products will find their way into the operating system or business applications. In their place, new products and technologies will emerge that will extend the manageability and productivity of the platform.

To evaluate the impact of modular computing and its associated costs and benefits, Giga compared two different scenarios. The first scenario established a current baseline where we assumed that during the next 36 months the organization would continue on its existing life-cycle path and not incorporate the UPC device into the asset portfolio. The second scenario examined the changes of including UPC device into the current asset mix.

Assumptions

The purpose of this document is to build a framework for the anticipated value statements around the investment in UPC devices. To that end, it is necessary to build a sample environment to apply and quantify the sample cost and benefit statements. For the purpose of this analysis, we are looking at a given organization with a three-year life cycle for desktops and notebooks. At the start of the analysis, there are roughly 2,500 end users. Giga assumes organizations that focus most on executives and support and sales would be the primary initial users. A significant percentage of the user population travels outside of their home office. Each user has either a desktop or notebook, and some users have both a desktop and notebook at their disposal. In addition, there is a certain percentage of the population that owns a PDA device. The IT organization supports several different devices including Palm, Windows OS based, Symbian and RIM. Table 1 illustrates the current classification of users by device type. It is important to note that this breakdown is based on an environment where new technology is aggressively adopted and the workforce is predominately mobile.

Table 1: User Allocation (Current Environment)

Supported PDA's (by group)				
	Percent	Number	Percent	Number
Exclusively desktop	55%	1,375	20%	275
Exclusively notebook	30%	750	40%	300
Combination desktop/notebook	15%	375	40%	150

Source: Giga Information Group

We are assuming a 5 percent employee year-over-year growth among the end-user community for the entire three-year analysis. As a result, the breakdown of end users among the three years translates into Year 1(2,500 users), Year 2 (2,625 users), Year 3 (2,756 users). Based on these assumptions, if the organization did not invest in UPC devices, the current asset growth statistics are shown in Table 2. This environment is the baseline with which the relative cost and benefits are measured compared to investing in UPC devices.

Table 2: Current Scenario

Current Scenario	Year 1	Year 2	Year 3
Total users	2,500	2,625	2,756
Exclusively desktop	1,375	1,444	1,516
Exclusively notebook	750	788	827
Combination	375	394	413
PDA	725	870	1,044
Devices			
Desktop	1,750	1,838	1,929
Notebook	1,125	1,181	1,240
PDA	725	870	1,044
PDA users by device			
Exclusively desktop	275	330	396
Exclusively notebook	300	360	432
Combination	150	180	216

Source: Giga Information Group

For the purpose of this analysis, Giga assumes the company will transition a portion of its users over to the UPC device. In the transition, users will give up their current desktop and/or notebook as well as their PDA in place of a single UPC device. It is important to note that due to the relative infancy of this device, Giga assumes that not all users will be transferred within the three-year period, but instead only a portion of users within each category. The UPC devices will be introduced as part of the normal 36-month life cycle around for PC refreshes. The transition schedule by user is listed in Table 3:

Table 3: Transition of UPC Device (by User Type)

Percent of Users Transferred	Year 1	Year 2	Year 3
Desktop	10%	15%	20%
	138	217	303
Users w/o PDA	110	178	241
Users w/ PDA	28	39	62
Notebook	15%	20%	30%
	113	158	248
Users w/o PDA	68	110	162
Users w/ PDA	45	48	86
Combination	15%	30%	40%
	56	118	165
Users w/o PDA	34	94	131
Users w/ PDA	23	24	34

Source: Giga Information Group

As a result, with the introduction of the UPC devices, the environment based on this transition schedule would be as follows:

Table 4: Environment Based on Transition Schedule

	Year 1	Year 2	Year 3
Total users	2,500	2,625	2,756
Exclusively desktop	1,238	1,227	1,213
Exclusively notebook	638	630	579
Combination	319	276	248
PDA	419	378	327
UPC	306	492	717
Devices			
Desktop	1,556	1,503	1,461
Notebook	956	906	827
PDA	419	378	327
UPC	306	492	717

Source: Giga Information Group

These assumptions will be used throughout the report. As mentioned above, the purpose for this document is to illustrate the process of calculating a value to a given organization. Readers should take this framework and apply it to their own environment.

Comparisons of Costs

This section applies the principles of TEI to build a rough framework for evaluating the value proposition of the UPC device. We will first examine the IT impact, measured primarily in terms of cost and cost reduction, and then examine the end-user impact of the device.

IT Impact

The introduction of a UPC device into an organization's refresh cycle can potentially impact IT both positively and negatively. Increases in cost can be seen in terms of growth in asset allocation cost with the introduction of the UPC devices. However, these increases are balanced by the potential reduction in support costs as well as internal IT efficiencies of the IT environment. To determine the impact of purchasing the UPC device on the organizations purchasing budget, the following assumptions were made around the cost of each type of device:

Table 5: Assumptions on Device Costs –Year 1

UPC	Amount ($)
Base Module	1,500
Peripherals	600
Notebook Extension	500
Total	*2,600*
Standard Configuration (desktop)	
Desktop Computer	900
PDA	300
Total	*1,200*
Standard Configuration (notebook)	
Notebook Computer	1,700
PDA	300
Total	*2,000*
Combination	
Desktop Computer	900
Notebook Computer	1,700
PDA	300
Total	*2,900*

Source: Giga Information Group

From the assumptions provided, the notebook and desktop purchase price come in significantly lower than the cost to purchase the UPC device. The one case where the initial up-front cost would be higher continuing with the current scenario would be comparing the purchase of the UPC device to the bundled combination of desktop and notebook. As the current assumptions indicate, the number of users that have both devices is limited.

Other assumptions made around these estimates are that these estimates include the cost to procure as well as other hardware costs to integrate these devices into the organization. Giga also assumes a 15% yearly cost decrease for both notebooks and the desktop devices and 10% yearly decrease in costs for the desktop. Table 6 illustrates the changes in procurement cost using the current transition timeline as a guide.

Table 6: Procurement Cost Using Current Transition Timeline

Hardware	Year 1	Year 2	Year 3
Desktop			
Number of Users	138	217	303
As Is	$1,200	$1,080	$972
UPC	$2,600	$2,210	$1,879
Difference (per user)	($1,400)	($1,130)	($907)
Difference (total)	($192,500)	($244,716)	($274,839)
Notebook			
Number of users	113	158	248
As Is	$2,000	$1,700	$1,445
UPC	$2,600	$2,210	$1,879
Difference (per user)	($600)	($510)	($434)
Difference (total)	($67,500)	($80,325)	($107,535)
Combination			
Number of Users	56	118	165
As Is	$2,900	$2,465	$2,095
UPC	$2,600	$2,210	$1,879
Difference (per user)	$300	$255	$217
Difference (total)	$16,875	$30,122	$35,845

Source: Giga Information Group

Based on the figures calculated above, the net impact of the introduction of the UPC devices in the cost to refresh is negative across the three years, with a $243,125 increase in costs in Year 1, $294,919 in Year 2 and $346,530 in Year 3. Assuming a discount rate of 8 percent, the net present value (NPV) of the net cost to introduce the devices is $753,047.

Coupled with the increase in costs, Transmeta asserts that there are potential decreases to IT costs around support and administration. Table 7 illustrates the potential assumptions around the cost to support current devices.

Table 7: Potential Assumptions Around Cost to Support Current Devices

Monthly costs to support (by user type)					
Desktop	$125	per month	+PDA	$50	
Notebook	$135	per month	+PDA	$50	
Combination	$270	per month	+PDA	$50	
Yearly costs to support (by user type)					
Year 1		**Year 2**		**Year 3**	
w/o PDA	w/ PDA	w/o PDA	w/ PDA	w/o PDA	w/ PDA
$1,500	$2,100	$1,500	$2,100	$1,500	$2,100
$1,620	$2,220	$1,620	$2,220	$1,620	$2,220
$3,240	$3,840	$3,240	$3,840	$3,240	$3,840

Estimates around support are based upon the average cost an outsourcer would charge for this type of environment. It is based upon the complexity of the end user environment.

The introduction of UPC devices has the potential to alter the impact of cost of support for some end users. Giga assumes that there is a reduction in the number of unique devices to be supported. This includes supporting PDA's as well as users that were using both a laptop and desktop. We assume that the support requirements are going to follow the typical level of support for notebook computers.

Based on these factors, Giga estimates the potential resource support requirements to be:

Table 8: Potential UPC Costs (Support)

Year 1		**Year 2**		**Year 3**	
Per Month	Year	Per Month	Year	Per Month	Year
$150	$1,800	$145	$1,740	$145	$1,740

Source: Giga Information Group

The support costs are higher in Year 1 as a result of the unfamiliarity of the initial adopters to the product. This is offset, however, by the overall positive impact in reduction in support as a result of the introduction of the UPC device. As a result, the net support benefit from moving toward UPC is illustrated in Table 9.

Table 9: Organizational Savings (Support)

	Savings Per User					
	Year 1		**Year 2**		**Year 3**	
	w/o PDA	w/ PDA	w/o PDA	w/ PDA	w/o PDA	w/ PDA
Desktop	$(300)	$300	$(240)	$360	$(240)	$360
Notebook	$(180)	$420	$(120)	$480	$(120)	$480
Combination	$1,440	$2,040	$1,500	$2,100	$1,500	$2,100
	Total Savings					
	Year 1		**Year 2**		**Year 3**	
	w/o PDA	w/ PDA	w/o PDA	w/ PDA	w/o PDA	w/ PDA
Desktop	$(33,000)	$8,250	$(42,641)	$14,001	$(57,830)	$22,402
Notebook	$(12,150)	$18,900	$(13,140)	$23,040	$(19,400)	$41,472
Combination	$48,600	$45,900	$140,528	$51,323	$196,739	$71,853
Total	$76,500		$173,112		$255,236	

Source: Giga Information Group

The net savings, over a three-year period, is estimated to be roughly $421,864 based upon a yearly discount rate of 8%.

In addition to direct support requirements, Giga sees several areas where IT benefits can potentially be realized. One area is the potential for reducing the likelihood for multiple versions of software for multiple OS systems. Standardizing on a single UPC device has the potential to reduce the number of application licenses inventoried. For the purpose of this analysis, we assume that there will be savings for users that currently have a desktop and notebook combination and are migrating to a single UPC device. Table 10 illustrates the value created from the elimination of multiple devices.

Table 10: License Cost Savings

		Year 1	Year 2	Year 3
Number of combination devices removed		56	174	340
Licensing cost per year per user	$192			
Total license costs avoided		$10,800	$33,480	$65,232

Source: Giga Information Group

As a result of consolidation, total net present value savings equate to $90,487 over three years.

With consolidation of the operating system, there is the potential of not only the direct reduction in licensing costs but also the reduced IT support costs from having to manage fewer desktop images. For the purpose of this analysis, we assume that before the migration of UPC devices, a the total yearly support for image consolidation was equal to eight full-time equivalents (FTE) to support 12 different PC images. Reducing the number of images to four across all different types of devices can potentially reduce the level of support by 25 percent. This equates to a reduction of support from eight FTEs to six. Table 11 illustrates the value created from image consolidation. Giga assumes that during the first year, benefits will be reduced by roughly half due to the time it takes to transition staff to other duties.

Table 11: Savings from Image Consolidation

Savings from image consolidation				
FTE requirement to support images before	8			
FTE requirement to support images after	6			
Average cost of FTE	$120,000			
Three-year cost savings	$240,000			
		Year 1	Year 2	Year 3
Total savings		$40,000	$80,000	$80,000

Source: Giga Information Group

In addition to the savings as described above, another potential area of savings occurs around the reduction in onsite visits for PC support and maintenance. Transmeta asserts that there is potential savings for IT as users can more easily send their devices back directly to the support headquarters, reducing the likelihood for an onsite visit. However, it is important to note that the benefits around the UPC device are similar to those of a notebook computer. The compelling reason for onsite visits is to minimize the downtime for the end user. As in the case of notebooks, end users still would encounter downtime as they did not have direct access to information on their device. Benefits could be realized if the organization installed a backup device that would allow easy replacement of a device, minimizing downtime and potentially reducing the likelihood that an onsite visit would be required.

End-User Benefit

The impact to the end user of a UPC device is a key criterion in determining the overall value of the product to the organization. Transmeta and Antelope assume that end users will be more productive with the use of a single device compared to two separate devices. The assumptions included are based on just the transfer of the current users of both desktops and notebooks to the UPC device and illustrated in Table 12.

Table 12: Synchronization Savings

Average synchronization time (minutes)	10		
Number of synch per week	3		
Fully burdened hourly salary	$25		
Productive time recovered	4%		
Yearly synch time saved (in hours)	14.4		
Productivity benefit per user	$360		
	Year 1	**Year 2**	**Year 3**
Savings from synch	$110,250	$177,188	$257,985

Source: Giga Information Group

In addition, there are benefits around not having to switch between two or even three devices. This can include the time to configure the devices as well as the time to transfer information that is not included as part of the original synchronization. The assumptions are listed in Table 13.

Table 13: Switching Savings

Average switching time	10		
Number of times switched between devices	3		
Fully burdened salary	$25		
Productive time recovered	4%		
Yearly switching time saved (in hours)	14.4		
Productivity benefit per user	$360		
	Year 1	**Year 2**	**Year 3**
Savings from switching	$110,250	$177,188	$257,985

Source: Giga Information Group

Flexibility

There are several ways to measure the value of flexibility of the UPC device. Flexibility is typically those benefits that can be realized in the future with an additional capital outlay on top of the initial investment around the device. Potential areas of flexibility can include:

- The use of 3G capabilities when the technology becomes available. Assuming that the device supports 3G, purchasing the device before 3G is available will not yield any immediate, direct benefits. However, once 3G is implemented the device can take advantage of 3G capabilities and as a result realize benefits.
- Being able to standardize and consolidate accessories around a common device allows procurement of devices at a lower cost.

Flexibility was not quantified due to the relative newness of the UPC technology.

Risk

Measurement of risk is a way of incorporating the level of confidence and uncertainty regarding the cost and benefit estimates of a given investment. Higher confidence that the costs and benefit estimates will be met implies that the

level of risk is lower and the variation between the risk- and non-risk-adjusted outcomes would be minimal. In the case of this representative example, the following assumptions are made around the level of risk:

For the cost estimates:

- The cost of hardware is assumed to be accurate at the time of printing of this document, and as a result, Giga assumes little variation around the estimate.
- Estimates around the cost of software are assumed to be conservative, and as a result, the level of additional risk applied is minimal.
- Estimates around the cost of support are assumed to preliminary and should not be used as a guide in determining the support requirements for the UPC device. With the level of uncertainty around support to be significant, Giga has applied a wide variance around the cost of support.

For the benefit estimates:

- Estimation of benefits is typically more uncertain than measurement of costs. This is due to both the potential that end users will not change their behavior as well as the fact that a given organization will not go back and measure the benefits that are being created.
- One of the key value propositions around the use of the UPC device is that it has the functionality of a PC with the size of a PDA. As a result, end users are expected to do away with the use of their PDA and use a single UPC device. However, the likelihood that the end user will do away with the devices that they are currently using is potentially a major risk around the value proposition of the UPC device.

The below analysis illustrates the potential steps required in measuring risk around the cost and benefit estimates. Giga's use of the triangular distribution model creates a range of possible outcomes around each cost and benefit estimate. Once the range is constructed, the mean of that distribution translates into the risk-adjusted estimate. In terms of risk to cost, Giga assumes there is a significant amount of uncertainty around the cost to support a UPC device. As a result, the risk to the original cost estimates were bounded by both a high and low value to take into account the level of uncertainty. For the purpose of this analysis, Giga assumed a low estimate that was 90 percent of the original cost estimate and 130 percent of the original value of the high estimate. For example, in Year 1 the non-risk-adjusted value for cost was estimated to be at $150 per month. The low estimate was 90 percent of that value, or $135 per month, and the high estimate was 130 percent of that value, or $195 per month. Based on that value we can project a risk-adjusted value of $160 per month, which takes into account both the high and low estimates.

Table 14: Risk-Adjusted UPC Support Costs

		Year 1		Year 2		Year 3	
		Per Month	Year	Per Month	Year	Per Month	Year
Original Estimate		$150	$1,800	$145	$1,740	$145	$1,740
Low	*Percent of original*	*90%*		*90%*		*90%*	
	Value	$135	$1,620	$131	$1,566	$131	$1,566
High	*Percent of original*	*130%*		*130%*		*130%*	
	Value	$195	$2,340	$189	$2,262	$189	$2,262
Risk Adjusted	*Value*	**$160**	**$1,920**	**$155**	**$1,856**	**$155**	**$1,856**

Source: Giga Information Group

These risk-adjusted values in turn affect the operational savings from support as realized by the introduction of UPC devices.

Table 15: Difference in Support Savings Risk Adjusted vs. Non-Risk Adjusted

	Year 1	Year 2	Year 3
Non-Risk Adjusted	$76,500	$173,112	$255,236
Risk Adjusted	$53,250	$134,918	$201,875

Source: Giga Information Group

In terms of benefits, the key risk is the ability of the end users to accept the use of the UPC device as a substitute for the multiple devices that they are currently using. If users do not change their behavior or the benefits are not measured in the future, then the estimates can be significantly reduced. The tables below reflect the potential reduction in benefit values assuming that there is slow adoption to the devices.

Table 16: Risk-Adjusted Savings From Synch

	Year 1	Year 2	Year 3
Savings from Synch	$110,250	$177,188	$257,985
Low Estimate	10%	10%	10%
	$11,025	$17,719	$25,799
High Estimate	110%	110%	110%
	$121,275	$194,906	$283,784
Risk-Adjusted Estimate	$80,850	$129,938	$189,189

Source: Giga Information Group

Table 17: Risk-Adjusted Savings From Switching

	Year 1	Year 2	Year 3
Savings from Switching	$110,250	$177,188	$257,985
Low Estimate	10%	10%	10%
	$11,025	$17,719	$25,799
High Estimate	110%	110%	110%
	$121,275	$194,906	$283,784
Risk-Adjusted Estimate	$80,850	$129,938	$189,189

Source: Giga Information Group

Conclusion and Recommendations

Based on the current assumptions, the representative company can achieve a risk-adjusted return on investment with the introduction of the UPC devices of 57 percent. Return on investment is calculated using the following formula:

(Net Present Benefits – Net Present Costs) / Net Present Costs

Table 18: Non-Risk-Adjusted Costs and Benefits

	Year 1	Year 2	Year 3
Net hardware costs	($243,125)	($294,919)	($346,530)
Change in support costs	$76,500	$173,112	$255,236
End-user productivity benefits	$220,500	$354,375	$515,970
Licensing Costs Avoided	$10,800	$33,480	$65,232
Image Consolidation	$40,000	$80,000	$80,000
Net cash flow	$104,675	$346,048	$569,909
Net present value @ 8%	**$846,014**		
Return on Investment	**112%**		

Source: Giga Information Group

Table 19: Risk-Adjusted Costs and Benefits

	Year 1	Year 2	Year 3
Net hardware costs	($243,125)	($294,919)	($346,530)
Change in support costs	$53,250	$134,918	$201,875
End-user productivity benefits	$150,675	$242,156	$352,580
Licensing Costs Avoided	$9,720	$30,132	$58,709
Image Consolidation	$36,000	$72,000	$72,000
Net cash flow	$6,520	$184,288	$338,634
Net present value @ 8%	**$432,853**		
Return on Investment	**57%**		

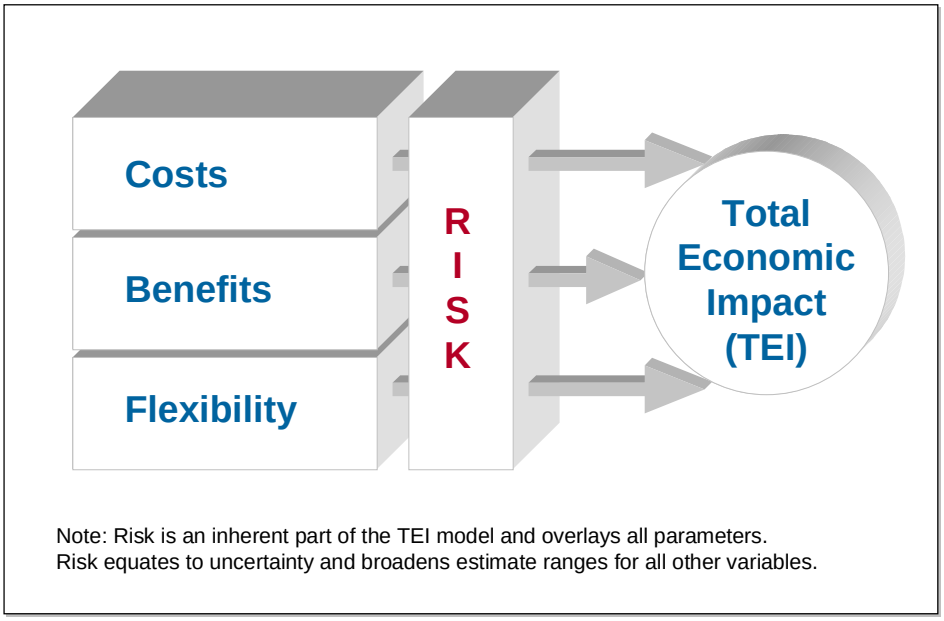
Source: Giga Information Group

As stated from the outset, the purpose of this document is to provide a guide to examine the potential value propositions around UPC as it applies to one's own internal organization. Since Antelope has currently not made their product widely available to enterprise customers through sales channels at the time of publication, it is important to keep in mind that this document should be used as a tool to validate one's own estimates and not use this document as a justification to purchase UPC devices. Giga makes no assumptions that other organizations will achieve similar results as to those cited in this report.

Appendix A: Total Economic Impact™ (TEI) Primer

Once the initial assumptions have been created, we can complete the framework for to examine the value proposition of the UPC device. This will be achieved through the application of Giga's Total Economic Impact™ (TEI) model. TEI is comprised of four separate elements: cost, benefit, flexibility and risk. For the purpose of this analysis, the value of flexibility is not quantified. However, in order to explain all parts of the TEI model, a brief description as to how Giga quantifies the value of flexibility.

Figure 1: TEI Conceptual Diagram



Source: Giga Information Group

Benefits

Benefits represent the *value* delivered to the business by the proposed project. Oftentimes, IT project justification exercises focus on cost (e.g., TCO) and cost reductions. Among industry leaders, IT is deployed as an offensive weapon, with value expectations that exceed mere cost reduction. TEI captures the value proposition of the proposed project by measuring the benefits against the incurred costs.

All benefits captured by TEI must be traceable back to one or more critical success factors (CSFs). These CSFs are directly linked to a higher-level business strategy. If a proposed technology investment generates benefits that cannot be satisfactorily linked to a CSF, then it will not be included as a benefit for the organization in the model. In these cases, TEI requires that the benefit be discarded.

Under TEI, benefits may only accrue to the business units. "Benefits" derived through cost reductions within IT accrue as negative TCO to the IT budget, thereby showing a reduced TCO (TCO is considered by TEI to be a single-dimension, cost-centric focus on the IT budget).

The TEI process begins with a discovery of potential benefit areas. A representative, with the ability to capture the benefit in question, from the organization under examination must validate each benefit captured during discovery. In other words, values cannot arbitrarily be assigned to a benefit if that person is not in a position to deliver that benefit should the project be approved. Additionally, projects that are expected to deliver business value require some effort on the part of the business to realize that value. That effort may be in the form of training, organizational change or a modification of extant business processes. Therefore, TEI requires dialog with the actual business leaders who are responsible for making the necessary changes in order to capture the proposed benefit during the

justification phase. TEI captures this dialog in the form of the name of the individuals, which validated the value calculation of each benefit.

Within TEI each benefit entered has a specific capture date. Although the benefit may be captured over time, TEI requires the specification of a date when most of the benefit has been captured. TEI will then place the value delivered in the appropriate time frame within the project.

Costs

Costs represent the investment necessary to capture the *value*, or benefits, of the proposed project. IT or the business units may incur costs. These may be in the form of fully burdened labor, subcontractors or materials. Additionally, costs consider all the investment and expenses necessary to deliver the value proposed.

Flexibility

Flexibility, as defined by TEI, represents investing in additional capacity that can, for some future additional investment, be turned into business benefit. For instance, an investment in an enterprisewide upgrade of the desktop word processor application where the primary driver may be standardization (to increase efficiency) and licensing (to decrease IT costs). However, a collaborative workgroup feature may translate into greater worker productivity when the organization is ready to absorb the discipline necessary to capture that benefit. The collaboration feature does not promise benefit during this phase of the project and must be captured later, incorporating additional investment, most likely in the form of training. However, the existence of the option has a present value that can be estimated. The flexibility component of TEI captures that value.

Flexibility can also be calculated by acknowledging that management has several decision points along the way for any given project. At each decision point, management can steer the project to a different outcome or cancel it altogether. Many net present value (NPV) evaluations fail to take this *management flexibility* into account. Since TEI's flexibility component uses the industry standard Black-Scholes options formula, the management flexibility factor is taken into consideration.

TEI divides a project into multiple phases. The first phase is considered the "benefits" phase — it is the phase expected to deliver the primary benefits. The benefits phase is usually no more than one budget cycle long, and is the primary reason the project is being considered. All other phases are "options" or "flexibility" phases. For additional investment at some point in the future, business benefit can be captured during these "options" phases.
TEI applies the Black-Scholes options pricing equation to all phases other than the benefits phase. The Black-Scholes equation uses five inputs to calculate the present day value of flexibility or options. The five inputs are:

1. The value, or business benefit, that can be captured when the option is exercised; this value is expressed in present value terms.
2. The time to the date at which point the option or flexibility expires. Expiration could be due to business changes or technology obsolescence.
3. The cost of the investment to exercise the option and to capture the benefit.
4. The risk-free interest rate (typically the interest rate of government securities is used).
5. The volatility of the industry or sector; TEI uses the volatility of the stock prices within the market sector as this input.

Risk

Risks are used to widen the possible outcomes of the project. Since the future cannot be accurately predicted, there is risk inherent in any project. TEI captures risk in the form of risks-to-benefits and risks-to-costs.

Risks-to-benefits consider all possible risks to each possible benefit. Likewise, risks-to-costs consider all possible risks to each possible cost. Then, a range is chosen by applying best judgment for each cost and benefit, based on the set of risks assigned to each cost and benefit. The range is entered in the form of a low estimate, a most likely value,

and a high estimate. For example, the risks to a cost may result in a range from the expected value as the low estimate to two times the expected value as the high for a particular cost (representing a potential two times cost overrun).

TEI applies a probability density function known as "triangular distribution" to the values entered. The expected value — the mean of the distribution— is used as the risk-adjusted cost or benefit number. The risk-adjusted costs and benefits are then summed to yield a complete risk-adjusted summary and ROI.

Typical project risk factors to consider include the following:

- Vendors — The risk that the vendor of a product or technology may need to be replaced at some point during the project duration
- Products — The risk that a product will not deliver the functionality expected
- Architecture — The risk that the current product architecture will not allow future infrastructure decisions and changes
- Culture — The risk that an organization will be unable to absorb the new technology or adapt to its implementation
- Delays — The impact on revenues of a project delay or cancellation
- Size — The direct correlation of project risk to the size of the project, as measured by application size or budget

Interpretation of the Financial Figures

The summary of the report is divided into two sections — the standard ROI and the risk-adjusted ROI. The parameters are defined as follows:

- Return on Investment : Return on investment is an indication of the value achieved from moving forward with a given technology solution. It is based upon the difference between benefits and costs accrued over the life of the investment. Return on investment is calculated as follows :

$$\frac{(net\,benefits - net\,costs)}{net\,costs} = Return\,on\,Investment$$

- Risk Adjusted Return on Investment: Risk adjusted Return on Investment is calculated using the same equation for return on investment. However, cost and benefit estimates have been adjusted to reflect the level of uncertainty within the given solution.
- Net Present Value discount rate: As time moves forward, the purchasing power of money diminishes. The NPV discount rate attempts to capture the rate of decay of the purchasing power of money. This allows ROI calculations to be stated in present-day monetary units. The discount rate shown is the annual rate.

The UPC Market: Handheld XP Solutions for the Enterprise

White Paper

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The UPC Market: Handheld XP Solutions for the Enterprise

White Paper

Market Dynamics

Enterprise users require mobile capabilities today more than ever before. Mobile users require real time collaborative data like email, instant messaging, and networked enterprise CRM applications. Likewise, enterprise users count on the ability to send word processing documents, spreadsheet files, multimedia files, digital pictures, and other types of collateral easily between users. And, they need the ability to use their Microsoft Windows-based applications out of the box as much as possible. By successfully tying together business critical data, and enabling users to access documents and applications anywhere, mobile capabilities increase the company's overall responsiveness and competitiveness.

At the same time, today's cost-conscious business climate requires especially prudent choices about which IT purchases to make, driving the careful scrutiny of computing solutions. IT buyers evaluate these options both in terms of capabilities and the total cost of ownership provided to the organization. In recent years, increasing demands for mobility has fueled the deployment of notebooks and handheld personal digital assistants (PDAs) to solve various pieces of the computing equation. IT departments turn first to PC technology to satisfy the needs of the information worker to be connected to business-critical data and applications both at work and when traveling. Notebooks provide a desirable solution to this problem, because the capabilities of a notebook can draw upon applications, networking, and all the other options provided in the PC marketplace. The portability of many notebooks, however, is limited, notebooks require table space, and after the expiration of a relatively short battery life, a power supply.

The goals of increased portability beyond what a notebook can provide have driven the deployment of PDAs into the notebook segment as notebook companions. The PDA is easier to use in the hand, when standing, and in general while traveling. This portability aspect has been well received by mobile workers, driving PDA sales higher in recent years. Despite these portability advantages, PDAs have some flaws that limit their capabilities: deployment issues, increased support, and often an increase in total cost of ownership. Once these factors are considered, the net cost of PDA purchases in some mobile environments begins to look less desirable.

Central to the shortcoming of PDAs is the desirability to standardize the operating environment of the user around a single platform, reducing the number of environments the IT infrastructure must support. All PDA solutions in the marketplace today are built upon lightweight operating systems that lack full PC capabilities, thus introducing a second operating system that IT personnel must support.

This paper considers a new kind of device that may offer all the portability benefits of a PDA but with the rich capabilities of a PC notebook. This new solution has the potential to add a new option for mobile devices deployed by IT departments to mobile users.

Current Offerings for Mobile Users

There are a range of mobile solutions available today, each with advantages and disadvantages:

Traditional Laptop PC

The bulk of the laptop market is comprised of larger form factor notebooks, with 13-15" or larger screens. The attractiveness of these PC's stems from high performance, coupled with multiple IO sources like CD or DVD drives, large disk capacity, and so on. However, these PC's tend to be large and heavy—often six pounds or more—and offer limited battery life. The weight and battery life of these PC's often limits their portability and discourages users from keeping the PC with them at all times. Likewise, a mobile user has no choice but to use a laptop of this class on a desk or table, limiting the options for mobile use.

Likewise, a derivative of the notebook is the newly emerging category of Tablet PC's. While this market is in its infancy, we see increased interest and demand for Tablet PC's in some key enterprise markets, especially vertical segments where a "slate-like" orientation and pen input is desirable. Some example markets are in healthcare, Pharma and transportation, though Tablet PC's may also be used in other vertical segments as well

Ultra Light PC

Ultra Light PC designs are characterized by designs that are lighter and smaller than traditional laptops. Usually these devices have either a 10.4" or 12.1" and weigh less than three pounds. Laptops of this class typically provide only a single disk, relying on external drives for CD or DVD. The smaller size and weight of these systems dramatically improves the portability, reducing the burden keeping it with you more often. However, even the smallest Ultra Light notebook is difficult to use without a table. Likewise, a PC of this size requires a briefcase to carry, instead of pocket. And, because of their smaller size, they use a smaller battery that also limits their life while in portable environments.

PDAs (Palm, PocketPC, iPAQ)

Pocket PC-based handheld computers — also referred to as personal digital assistants (PDAs) — have become popular in Enterprises due to the design's high portability and large set of accessories. In addition, enterprises have been able to draw upon a large value added reseller (VAR) market for customizations. The ultra compact design of handhelds provides the ultimate in portability, with units so small they can be carried in a pocket or purse with ease. PDA deployments exploded in 2001 as companies realized the benefits these smaller handhelds offered for portability

Unfortunately with PDAs portability comes at a cost of limited capabilities. The limited capabilities and lack of true PC (X86) compatibility requires the porting of Enterprise applications to the Palm or Pocket PC OS, which can be a very expensive proposition. Consulting fees for these types of ports can be substantial and almost always provide more limited functionality than the original version due to the limitations of the PDA. One common rule of thumb states that customizing Enterprise applications costs from $500 to $1000 per user.

Additionally, the IT support burden of these devices is can be high since they cannot leverage the same PC infrastructure for software and maintenance. Also, PDA's limited storage and lack of application compatibility also means the PDA never holds a substantial amount of data, and may not be able to handle large important documents, presentations and multimedia files.

Blackberry / RIM Communicators

One alternative to the traditional PDA is the Blackberry device from Research in Motion. The Blackberry enables wireless email capabilities from multiple providers making it a highly desirable and powerful device in the Enterprise market from a connectivity perspective. However, users routinely complain about the limited functionality of Blackberry devices, particularly the inability to view attachments or use familiar applications. Deployment costs in terms of license and server fees for these devices can be very high as well.

The Ultra Personal Computer: Handheld XP

We believe a strong segment of users want full capabilities when mobile: using the applications they know, offering generous amounts of storage capabilities for large documents and media, and providing a robust email experience that is fully capable of downloading and viewing multimedia files and data attachments. At the same time, they desire the portability of a PDA and ability to easily carry the device anywhere.

A new alternative is emerging in the marketplace that has the potential to alter the mobile computing landscape by satisfying both of these goals simultaneously. This alternative is called an Ultra Personal Computer (UPC), a device that provides full Windows XP™ capability in the palm of your hand. Some have also referred to this as a "handheld XP" device.

UPC Characteristics

The UPC delivers the power and performance of a desktop computer and the functionality of a laptop computer in the size of a handheld PDA sized device. UPC's feature a high-resolution screen, internal hard drive, high-speed IO capabilities, and a keyboard (in various different styles). Since the UPC is a full featured handheld PC that runs with full x86 compatibility, it supports the breadth of x86 applications that are currently available and full Windows XP capability, eliminating the need for the porting and customization of Enterprise applications.

At the office. Powered by a 1GHz or faster processor, the UPC offers the performance one would expect of a reasonable PC so that demanding Enterprise applications can be used unmodified. In the office, the UPC can be physically or wirelessly connected with an associated docking cradle to an external monitor and keyboard to deliver a normal, comfortable office experience.

When Traveling. UPCs are lightweight, ranging from 8 oz – 1.4 pounds, and small enough to fit in a coat pocket or purse. This small size and weight means you can carry the UPC at all times without the burden you would expect from a notebook. UPC's will offer a range of input alternatives like integrated thumb keyboards or fuller size keyboards in several configurations. Different vendors coming to market at the end of 2003 and beginning of 2004 will offer a range of solutions to satisfy user preferences. Unlike PDA's that provide only limited storage capability, new 1.8" disk drives

enable capacities of 10GB-40GB in a small form factor that will clearly meet the needs of most mobile professionals.

High quality screens. The inclusion of very high quality screens in UPC devices allows users to have a rich Windows experience, easily viewing an entire Windows desktop in the palm of your hand. These screens, ranging from 4" on very small devices up to roughly 6", will offer resolutions from 800x400 all the way up to 1024x768. Many of the screens used in UPC devices were initially designed for portable video players or camcorders, so they are well suited to display high-resolution images and video. We believe users will be surprised at the high quality of the latest LCD screens, enabling a full Windows desktop to be viewed on a small screen. For those users with weaker eyesight, font sizes and display options can be changed to ensure visibility while mobile. Compared to most PDAs, the screen in a UPC is a pleasure to use.

Creative Strategies Analysis and Customer Feedback

Customer Feedback on UPC's from DCI/CRM Shows

Over the last six months, Creative Strategies has had a chance to show major enterprise buyers the concept of the Ultra Personal Computer during our DCI CRM shows. Most of the IT managers shown these devices were in the processes of evaluating the use of Pocket PC's within either field force or sales force projects, and in a few instances, they were to be used by CRM managers within campus environments. Their reaction to XP in a handheld was that of serious interest, but with a healthy skepticism about the ability to run real applications on a device that employs a small screen. However, the key to their interest was the ability to use Windows XP applications off-the-shelf and without any modifications or need for customization of the applications to be used.

Customer example. In one case, an IT manager was about to deploy 100 PDA's in a field force application and the software that would be used on the PDA was highly customized. The cost of the software customization was to be around $100,000. The IT manager put the software cost at about $1000 per PDA and had factored in another $250 of support costs *per device* over the life of the project. When asked about the potential of using a handheld device that could run XP instead, he surmised that he would still need to plan about $100 per device for custom drivers and some unspecified database hooks, but estimated he could do the software component of the project for about 90% less then originally forecasted. He also thought that since the handheld XP device was similar to an XP laptop in terms of support costs, the estimated that the projected $250 PDA support cost could be reduced by at least 50% over the life of the project.

Customer example. In another case, an IT manager was going to utilize a PDA that was to be used in a 150-person sales project. This manager felt that by using a UPC instead, with the Windows XP application they already have, he could reduce the costs for software customization by at least 70%.

Across these shows, we demonstrated the Ultra Personal Computer or handheld XP concept to about 35 IT managers who were looking at using a PDA in their CRM project. 60% said that they would highly consider one of these devices in their project even if the cost of the device were twice the price of a fully loaded PDA. Key to their acceptance of this new platform was the ability to use Windows XP applications as-is, avoiding the need to create either special software for a handheld device or develop customized software applications from the ground up.

However, the sticking point for all of them was the size of the screen. Since we could not actually demonstrate an Ultra Personal Computer device running Windows XP, they all questioned the ability to run a full-blown Windows XP application on a handheld that had a 4-6" inch screen. And, in all cases, they said that input would be a critical factor for them in determining their use of a UPC device. While most agreed that pen input was desirable, 60% said that they felt the device needed either an attached keyboard or have some type of keyboard as part of the overall solution.

Although the small screen was clearly a concern for these IT managers, the ability to run a Windows XP application out of the box was so important that a UPC would be of high interest for deployment within their CRM projects. The CRM projects where they had the highest interest in a device like this was for field or sales force deployments, though at least 30% said that they could see its use in CRM management projects as well. It is clear from the interviews with these CRM managers that key vertical markets such as healthcare, transportation, emergency services, insurance, real estate and other vertical segments could benefit from a device of this nature running full Windows XP applications.

Another area of interest to these IT managers was the ability to run Web hosted apps on this platform. Because UPC devices run Windows XP, they have full Web Browser support, instead of the limited browser capabilities on today's handhelds. Five of the IT managers had sales force projects in the works in which they were considering the use of SalesForce.com or Upshot.com. They immediately saw that a handheld XP device could be used within these hosted applications without any modifications. Network security support is also critical to accessing networked applications, and UPCs can readily support VPNs, as requested by IT managers we met. PDA's have traditionally been unable to handle industrial strength VPN security due to platform limitations.

The other key reason that this platform got such serious interest from these CRM IT managers was its ability to handle full email attachments with no compromises. Although the Pocket PC and Palm devices can handle attachments, their ability to allow for general editing is highly limited and for some file types, not provided. Since UPC devices will run all Windows XP applications, all attachments are fully viewable, and can be modified, updated and expanded at will. Another aspect of these devices is that they can also store large multimedia files on its hard drive and handle the processing necessary to support today's latest media types.

Customer example. We spoke with an IT executive from a multinational firm who had surveyed the field of mobile devices and had so far been unsatisfied. This buyer had already deployed a test of Blackberry devices and PDA's, but failed to find a satisfactory set of capabilities, battery life, and connectivity. When we reviewed the UPC concept, his reaction was strong, particularly to the ability to use wireless in a handheld portable device, but retain the ability to use full email capabilities including the manipulation of standard attachments and media types.

Keeping All Your Data With You

While we have pointed out the main merits of a device like this for use in CRM and potential IT mobile projects, there is one key technology component that we believe is critical to the success of an Ultra Personal Computer. The Ultra Personal Computer will, in many cases, find its place in an IT program as a secondary device in much the same way a PDA has today. Although we do see it being used mainly in mobile sales and field projects and within key vertical segments, it has the potential of being a highly mobile extension of a person's desktop or laptop in a more horizontal application.

As a result, we believe this platform should offer not only a cradle or USB direct connection, but also synchronization software that allows a person to sync the UPC with the desktop or laptop. In a PDA, the synchronization process converts PC files into a lightweight version suitable for a PDA's reduced capabilities. This process is fraught with difficulties, and often leaves users frustrated at the conversion process, or at the data that could not be stored on the PDA.

In a UPC device, synchronization does not need to convert file formats, or selectively leave data behind due to capability limitations. The synchronization layer is much richer, focusing on synchronizing the file system, Office application data, full email, attachments, as well as the full calendar, contacts, and notes. Where a rich enterprise notes system is in place, the synchronization process is far more capable of reflecting the database offline than could any PDA.

The real promise of an UPC or handheld XP device is its ability to be a more complete mirror of a person's primary PC that can fit in the pocket and be carried with them at all times. Unlike a PDA, after synchronizing a UPC, the user knows their full set of data is with them. Moreover, once mobile, the UPC can also allow the user to work with this information as if it was their primary device.

Work is under way from various software synchronization companies to provide this key component and we expect this to be a major part of the Ultra Personal Computer or handheld XP program by early 2004.

UPC Market Predictions

The emergence of a viable Windows-based handheld — one that contains the performance of a desktop computer and the power saving and efficient aspects of a notebook computer —will most likely become a disruptive technology in the mobile Enterprise marketplace. When considered from a total cost of ownership perspective, it can be argued that the UPC device is far less expensive than today's handhelds

Low Cost of Ownership

The street price of UPC devices will generally be comparable to some Ultra Light laptops initially, with cost reductions over time, ranging from $1000-1600. When compared to PDA solutions, that initially seems expensive. Upon further analysis one finds the price to be competitive,

PocketPC solutions used by the enterprise today often cost more than $500 for the base unit. Just like automobile accessories and prices, Pocket PC devices ship with only the most basic capabilities requiring users to individually purchase additional accessories to fully enable the complement of features offered by the platform. When appointed with accessories typical of the average enterprise user running business applications, that cost can quickly reach $1000. Even with all of the accessories, Pocket PC devices still do not provide the same level of features and functionalities as a UPC.

Table 1: Cost Example for an IPAQ Pocket PC Device

SUMMARY	SALES PRICE
iPAQ™ h5450 Pocket PC with Intel® (XSCALE) 400 MHz processor, 64 MB SDRAM / 48 MB ROM, 64K color, TFT Transflective LCD, MS Pocket PC 2002, 1250 mA-h Removable battery, one year parts and labor warranty, Bluetooth for iPAQ™ h5450, and Integrated Wireless LAN	$649.99
iPAQ™ Expandable Case	$19.99
iPAQ™ Extended battery for h5150, h5400, h5500	$119.99
iPAQ™ A/C Power Adapter	$27.99
iPAQ™ 128MB Memory Expansion	$69.99
Margi Presenter-to Go CF Card	$199.99
TOTAL	**$1,087.97**

As alluded earlier, there is a secondary cost associated with customizing enterprise applications. Between support costs and consulting fees, this is generally viewed as an additional cost of between $500 to $1000 per user.

Market Size and Rationale

We expect a deployment and adoption pattern for UPC devices to be similar to the historical adoption of Microsoft Windows CE.net and Pocket PC devices for the following reasons:

- UPC systems will primarily be targeted at corporate and Enterprise channels initially, just as the PocketPC platform was in 2000.
- The UPC devices of today are filling the same end user needs as Pocket PC devices did in 2000, but with significant cost and compatibility benefits
- Wireless is expanding rapidly, and the UPC platform is more desirable to leverage these technologies

However, the adoption rate will be slower than the Pocket PC devices in the Enterprise market due to the higher initial price of UPC devices. Despite the lower total cost of ownership, the higher initial price will slow the growth. IDC's estimates for Enterprise Pocket PC devices are between $500 and $600. Given these theories, it is our belief that the total available market (TAM) for UPC devices should be as follows:

Table 2: UPC Market Size Projection

Year	Market Projection
2003	30,000
2004	350,000
2005	1,000,000
2006	1,600,000 – 1,800,000

- **2003 — 30,000 Units** – This number represents the order forecasts as seen from various UPC device designers and manufacturers coming to market near term.
- **2004 — 350,000 Units** – This number represents a judged down fraction of the PocketPC adoption rate as the market takes hold. At least 6-8 devices of various styles and in various markets are expected to be available in the year 2004.
- **2005 — 1,000,000 Units** – This number represents half the Pocket PC device rates for the equivalent adoption schedule but takes into account second generation products in volume production. It is estimated that 3-4 more OEMs will arise and that UPC devices will reach a $1000 price point.
- **2006 — 1,600,000-1,800,000** Units – This estimated forecast represents mainstream devices that should be well under $1000 in cost by this time

Summary of Market Trends and UPC Adoption

It is our opinion that the Ultra Personal Computer or handheld XP is a valuable product category and has real potential within various enterprise applications. Our projected forecast above reflects our view of the adoption cycle for UPC devices based on its unique value proposition, cost trends over time, and market expectations. In 2003, UPC's will be entering the market at a time when mobile computing is rebounding and enterprise buyers have many choices in front of them for use in their various business environments. We believe this is an opportunity for new devices like UPC's to see significant interest.

As for positioning, we believe that the Ultra Personal Computer or handheld XP platform will initially go head to head with PDA's in various enterprise markets, and be especially attractive in major verticals where mobility and full Windows compatibility is a key part of the application. We continue to be bullish on the role of PDA's as personal digital assistants and see them increasing their role in managing personal contacts, schedules and highly personalized information for business users of all types. We also see PDA's continuing to gain market acceptance in many enterprise programs where mobility is important and the applications deployed are available off the shelf.

We believe, however, the current move of PDA's is towards more consumer-focused applications. Devices are shifting to incorporate digital cameras, support for MP3 music files, and ability to play rudimentary video. The emphasis of these new functionality choices, combined with a move towards

aggressive price points suggests that any major growth for PDA's may be with consumers and not necessarily with enterprise markets that have more stringent requirements

The new category of TabletPC's has also caused users to rethink somewhat the form factors for computers they use. While TabletPC's have gained some acceptance, it is our contention that many of those same sectors would also benefit from the increased portability offered by a UPC. Some UPC's will offer pen-based input as well, further increasing the ways that a UPC can be utilized.

While initially UPC devices will be offered at higher price points, we believe these prices will drop quickly over time. The price of LCD panels and compact hard disks—some of the major cost drivers of a UPC—will drop rapidly as they are incorporated into more devices. We believe that as the prices for UPC's decrease to the price ranges of today's high end PDA's, they may likely receive more widespread acceptance.

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