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Appendix A

Examples from Manufacturers in the Key Sections of Design for Environment (DfE)

Environmentally Sensitive Chemicals

Mercury: Examples of industry accomplishments and commitments in phasing out mercury are provided below:

- Apple launched a mercury-free computer, MacBook Pro, in 2008.¹
- ASUS' N-series notebooks, launched in October 2008, use LED technologies, with no mercury included.²
- Dell has committed to switching all of its laptops to energy-efficient and mercury-free LED displays within the next two years, with the first line of mercury-free laptops scheduled to ship in December of 2008.³
- Sony's XEL-1 is the first OLED (organic light-emitting diode) flat-screen TV to be available in the U.S.⁴ This type of LCD backlighting does not contain mercury, has a longer lifespan, and uses less power than CFL systems that contain mercury.
- Sharp is working towards LED backlighting for their Aquos TV lines.
- In 2007, HP introduced the HP Compaq 2710p Notebook PC and the HP Compaq 2510p Notebook PC, which use LEDs instead of mercury lamps as a light source.

Arsenic:

- Apple's MacBooks boast arsenic-free glass and lead-free circuit boards, among other features. Apple plans to completely eliminate the use of arsenic in all of its displays by the end of 2008.⁵

Flame Retardants:

Selected examples of commitments made, and milestones achieved, by manufacturers include:

- Nokia aims to have all new models free of BFRs and antimony trioxide by the end of 2009.⁶
- Dell currently prohibits the use of PBBs and PDBEs (including Deca-BDE) for all applications, and the use of all other BFRs (including TBBP-A and HBCD) in plastic parts for desktops, notebook and server products. As well, Dell requires TCO certified displays and Blue Angel certified printers.⁷
- HP has eliminated tetrabromobisphenol A (TBBP-A) from external case parts of all new HP brand products since December 31, 2006.
- Lexmark has eliminated the use of BFRs in the covers and chassis of their laser and inkjet printers.

¹ www.macworld.com/article/131583/2008/01/macbookair.

² "ASUS N Series Notebooks Finally Make EPEAT Gold," Jaymi Heinbuch, www.treehugger.com/files/2008/10/asus-n-series-notebooks-finally-get-epeat-gold.php, 10/9/08.

³ <http://news.cnet.com/crave/?keyword=%22family%22>

⁴ http://ces.cnet.com/8301-1_1-9842035-67.html

⁵ www.apple.com/hotnews/agreenerapple/

⁶ www.greenpeace.org/raw/content/international/press/reports/greener-electronics-nokia-rank-4.pdf

⁷ www.dell.com/content/topics/global.aspx/corp/environment/en/dell_bfr?c=us&l=en&s=corp

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- Lenovo prohibits BFRs from intentional addition to any newly released parts except for printed circuit cards, cables and electrical assemblies. Lenovo's target for elimination of BFRs from intentional addition to all remaining parts is 2009.

PVC:

- HP has voluntarily removed PVC from most applications, except for wires and cables, and certain retail packaging.
- Lenovo currently prohibits use of PVC in external cover parts of more than 25 grams. Lenovo's target for elimination of all use of PVC is 2009.
- Lexmark has removed PVC in its inkjet cartridge packaging by replacing it with a combination of paperboard and either high-density polyethylene (HDPE) or polyethylene terephthalate (PET).

Environmentally Preferable Materials Selection

Dematerialization:

Some examples of dematerialization efforts by manufacturers include:

- HP All-in-One products that combine printers, scanners, copiers and fax machines in a single unit can reduce material usage by up to 40%, compared to separate standalone devices.⁸
- Striving for dematerialization, Canon's multi-function device, the MP610, has a body design that has 46% less volume and 19% less mass than the previous model MP760.
- Apple has focused on material efficiency for many years with ultra-compact product designs — reducing waste and energy consumption and maximizing shipping efficiency.⁹

Additional examples are also provided in Section 7, on expandability.

Packaging Optimization:

There has also been much work done in reducing packing materials:

- One of the most innovative examples is the HP Pavilion dv6929wm notebook. At retail outlets, this notebook, its battery, AC adaptor, cord and documentation, are all packed in HP's messenger carry bag with an inflated plastic bag for cushioning, thereby reducing product packaging by 97%, and providing a re-usable bag for the product owner.
- Other examples of industry packaging dematerialization are provided by Apple¹⁰. Its MacBook packaging uses 41% less volume resulting in 25% more units per shipping container.
- Packaging for the current generation 20-inch iMac uses 66% less plastic and 42% less paper than the 20-inch iMac G4 flat panel, while taking up 41% less space.
- iPod classic packaging consumes 35% less weight and 82% less volume than the first generation iPod.

Recycled Content:

Examples of progress made in the use of post-consumer recycled content in the industry include:

- Lenovo's product lines all use recycled plastic and metal; the gold, silver and other precious metals are recovered from end-of-life (EOL) products. In 2007, Lenovo's ThinkVision L193p monitor was the first product in the EPEATTM registry to use more than 25% post-consumer recycled content in its plastic parts. Overall, 1 % of Lenovo's total plastic usage in 2007/08 was from recycled sources, including both post-consumer and post-industrial content.

⁸ www.hudson-consulting.com/Sustainability_and_dematerialization_at_HP.pdf

⁹ www.apple.com/environment/design/

¹⁰ www.apple.com/environment/design/

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- HP's closed loop cartridge recycling program was an engineering breakthrough that enables the use of post-consumer recycled plastics in the production of new Original HP inkjet print cartridges
- 83% of HP's Deskjet D2545 printer total plastic weight is made up of recycled plastics.
- HP used more than 5 million pounds (2,300 tonnes) of recycled plastic in its original HP inkjet cartridges in 2007, and the company was committed to using twice as much in 2008.
- In 2007, Sony achieved a reused/recycled materials utilization rate of approximately 11% by increasing the amount of recycled materials.¹¹

Renewable/Bio-Based:

Some progress is being made. For example:

- In October 2008, Canon and Toray Industries announced the successful development of the world's first bio-based plastic applicable for use in multifunction office systems, with the highest level of flame retardance (5V classification) under the UL 94 flammability-testing program. The new bio-based plastic, which includes more than 25% (by weight) of a plant-derived component, will be used in exterior plastic parts for Canon multifunction office systems – to be launched beginning in 2009.¹²
- In companies such as Apple and Fujitsu, bio-based materials use has been limited to packaging applications.^{13,14}

Emerging Materials:

- Apple uses aluminum for the body of the MacBook Pro; the casing is a single piece of solid, recyclable aluminum that replaces dozens of extraneous pieces.¹⁵
- Another example of unconventional material use is the Dell Hybrid. According to Dell, the Hybrid is its greenest consumer desktop PC. It is the company's most compact design, at approximately 80% smaller than standard desktops, and it uses about 70% less power than a typical desktop. One feature that sets this designer PC apart is the ability to interchange its sleeve coverings, including leather and bamboo options.¹⁶
- In the summer of 2008, ASUSTeK launched the ASUS Bamboo Series notebook, a groundbreaking bamboo-clad product. ASUS maintains that this notebook is truly green throughout every phase of its life – from its conception, production and use to its eventual recycling and disposal.¹⁷

Energy:

- As Apple makes both the hardware and the software for the MacBook, the company is able to design them to work together. This allows it to make a smarter product that uses less electricity, earning it ENERGY STAR certification. For instance, to reduce energy consumption, the MacBook hard drive spins down automatically when inactive. The MacBook also decides which processor — CPU or GPU — is best suited to efficiently perform a task. The processor even throttles down to save power between keystrokes as you type. The LED-backlit display in the MacBook is another feature that plays an important part in conserving energy, consuming 30

¹¹ www.sony.net/SonyInfo/Environment/activities/reduction/products/index.html#block13

¹² www.i4u.com/article20788.html

¹³ www.apple.com/environment/materials/

¹⁴ www.fujitsu.com/global/news/pr/archives/month/2005/20050201-01.html

¹⁵ www.apple.com/macbookpro/environment.html

¹⁶ www.dell.com/hybrid

¹⁷ www.asus.com/news_show.aspx?id=12577

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percent less power than conventional LCD displays. And the display is designed to dim when the user enters a darkened room. Together, these adjustments make the MacBook family much more energy efficient. In fact, the MacBook, which can run on just one-quarter the power of a single light bulb, is Apple's most popular notebook.

- HP: Some notebook PCs with Intel SpeedStep Technology enable the processor to automatically switch to lower, power-saving speeds or to higher-performance speeds, depending on the workload.

Design for End-of-Life (DfEOL):

The electronics industry has made progress in recent years in several aspects of designing products to be more easily managed at end-of-life. For example:

- Apple recently announced that its new MacBooks and MacBook Pro notebooks feature a body made out of a single piece of aluminum, replacing the multiple types of plastics that were previously used.¹⁸ Of benefit to both users and the communities in which they live is Apple's choice to ship these new MacBooks in corrugated cardboard packaging that is 41 percent smaller than previously boxes, and to eliminate expanded polystyrene, a very hard-to-recycle type of plastic.
- HP is known for making products that are easily recycled, through use of common fasteners and snap-in/snap-out components. It avoids the use of glues, adhesives, and welds when possible, resulting in products that can be easily disassembled. HP's notebooks are now more than 90 percent recyclable or recoverable (by weight). HP established its DfE program in 1992, with an emphasis on design for recyclability to reduce the quantity and environmental impact of the materials in their products. The DfE program also addresses packaging. HP's Environmental Strategies Council coordinates the implementation of their DfE strategy.
- Lenovo, as a company with a long history of involvement in recovering its assets from its customers (in its IBM incarnation), and with present asset recovery services¹⁹, has long designed products for EOL management. For example, because it manages its own EOL stream of products, it recovers gold silver, and other precious metals.
- Sony reports it is labelling plastics for easy identification, and designing its products for easy dismantling.
- Lexmark Printers are designed for recyclability. By selecting materials that are recyclable, reducing the number of parts, limiting the variety of materials used, and designing products for ease of disassembly, more than 99 percent of the materials used in Lexmark's inkjet and laser printers can be recycled.
- Epson sets goals for recyclable rates (the ratio of total product weight calculated as recyclable based on a product's design drawings). It also considers ways to reduce the cost of disassembly and sorting. Epson is currently building its own system for recovering and recycling Epson products at the end of their useful lives.

¹⁸ "New MacBooks Made With Fewer Materials, Packaging, Chemicals", GreenerDesign Staff, October 15, 2008, www.greenercomputing.com/print/28641

¹⁹ www.lenovo.com/services_warranty/US/en/asset_recovery.html

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- Samsung Electronics has had a rigorous Life Cycle Assessment and “DfX” (Design for Assembly/Disassembly/Recycle/Service) protocol applied to its products since 1995.²⁰
- Canon plans, in its product development and design stages, to make products that are at least 65% recyclable and 75% recoverable; it carefully assessed products in 2007 and confirmed it was achieving these objectives.

Product Design – Convergence, Expandability, New Devices:

The following are some examples from Electronics Product Stewardship Canada (EPSC) member companies:

- Sony's all-in-one Vaio desktop computer combines 2 previously separate products - an HDTV and computer. Its PlayStation 3, with its built-in hard drive, wireless Internet access and multi-media features, combines many different products, such as a video game console, computer, and Blu-Ray player into one product.
- Brother's Multi-Function Centres combine printing, scanning, copying and faxing into the one unit. Brother has a range of 5-in-1 and 6-in-1 MFC, which combine any combination of features including fax, printer, copier, scanner, PC fax and telephone. Multi-function devices come with either laser or ink-jet printer technology.
- Apple's iPhone is a portable multimedia device combining the functions of a phone, music player and Internet device. A recent study by comScore indicates there is strong consumer support because of the iPhone's combination of features. "We see that lower-income consumers are increasingly turning to mobile devices to access the Internet, to listen to music and for email," said Mark Donovan, senior analyst at comScore. "A 'Swiss-Army knife of a device' like the iPhone offers a phone, a music player, a camera and a way to connect to the Internet, which may appeal to consumers cutting back their spending on gadgets."²¹

Cloud Computing:

EPSC member company Microsoft Corporation recently announced it would step into the world of web-based computing with a new system called Windows Azure. Microsoft is selling information storage space and computing power "in the cloud," distributed across massive data centres worldwide. That will enable companies to build web-based programs without having to manage their own data centres.²²

²⁰ www.samsung.com/us/aboutsamsung/corporateactivity/corpcitizenship/environmentsocialreport/CorporateActivityEcoDesignEvaluation.html

²¹ http://online.wsj.com/article_email/SB122532966811882759-1MyQjAxMDI4MjM1MjMzMjA5Wj.html

²² www.microsoft.com/azure/default.aspx

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Appendix B Electronic Stewardship Programs in Canada

In all operating e-waste collection programs in Canada to date (Alberta, BC, Saskatchewan, and Nova Scotia), provincial legislation requires brand owners and first importers of designated electronics products (usually televisions and computer-related) to be responsible for end-of-life management. To date, each of these four programs imposes a fee on designated electronics products, which is paid by consumers at the point of purchase. The fees are used to pay the cost of collection and/or transportation and recycling of end-of-life electronics. Electronics are typically collected at existing and new drop-off sites, some of which are municipal; others are container deposit-return locations. The legislation covers a wide range of electronic products that may or may not be phased in over a stipulated period of time. The table below summarizes details of the existing end-of-life electronics programs by province.

Jurisdiction	Key Dates	Program Financing	Products Targeted	Description
Alberta	Enacted: 2004 Effective: Feb 2005	Advanced disposal surcharge paid at point of sale: Monitors \$12, Computers \$10, Laptops \$5, Printers \$8, Televisions (size dependent) \$15-\$45	Televisions and computer equipment - monitors, CPUs/servers (including keyboard, mouse, cables, speakers), laptops, notebooks & printers	First province to implement a WEEE program in North America (followed by California 3 months later in January, 2005). Consumers pay an environmental fee that covers all costs for proper collection, transportation and management of the designated E-waste. Consumers and IC&I generators can take WEEE products to 249 drop-off locations
British Columbia	Enacted: Feb 2006 Phase 1 Effective: 2008 Extensive Phase 2 list of products announced December 2008	Environmental Handling Fee paid by consumer (both residential and Industrial, Commercial and Institutional IC&I) generators, ranging from \$5 for notebook to \$45 for TVs 46" and up	BC, Saskatchewan and Nova Scotia's Phase 1 list of designated products is identical to Alberta's list: Computers, monitors, printers and televisions (see detailed list in Saskatchewan description)	Industry launched ESABC (Electronic Stewardship Association of British Columbia) program in August 2007. Consumers and IC&I generators can drop off end-of-life electronics at 97 collection sites throughout the province
Nova Scotia	Enacted: Jan 2006 Effective: Feb 2008 (Phase 1) and Feb 2009 (Phase 2)	Environmental Handling Fee paid by consumer (both residential and IC&I) ranging from \$5 for notebook to \$45 for televisions, 46" and up	Phase 1: Computers, laptops, monitors, printers and televisions. Phase 2: Personal/Portable Audio/Video Systems, Vehicle Audio/Video Systems (Aftermarket), Home Audio/video Systems, Home Theatre in a Box (HTB) Systems, Non-Cellular Telephones	Consumers pay an environmental fee. End-of-life WEEE can be dropped off at 33 drop-off centres throughout the province. Industry established ACES (Atlantic Canada Electronics Product Stewardship Program) to manage end-of-life electronics

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Jurisdiction	Key Dates	Program Financing	Products Targeted	Description
Ontario	<p>Enacted: Dec 2004 Effective: Plan approved July 2008 Implementation expected: April 2009 Phase 2 to be implemented within one year of Phase 1</p>	Fees to be determined	<p>Phase-in approach 1st phase:</p> <ul style="list-style-type: none"> • Information Technology Equipment <ul style="list-style-type: none"> ○ CD-ROM drive ○ Computer disk drive, keyboard, mouse, terminals ○ Microcomputer & minicomputer ○ Monitors (CRT, LCD, plasma) ○ Personal computers (desktop, laptop, notebook, notepad) ○ Printer • Telecommunications Equipment <ul style="list-style-type: none"> ○ Fax machine • Audio-Visual Equipment <ul style="list-style-type: none"> ○ Televisions (CRT, LCD, plasma, rear projection) 	<p>Brand owners, manufacturers and first-importers of Phase 1 electronics and electrical equipment will be responsible for implementing the WEEE Program Plan. The industry will assume the cost and responsibility for transportation and handling of the WEEE, at an estimated Year 1 cost of \$62 million. Ontario Electronic Stewardship (OES) established to run the program,</p>
Saskatchewan	<p>Enacted: Oct. 2005 Effective: Feb 2007</p>	<p>Environmental Handling Fee paid by consumer (both residential and IC&I):</p> <ul style="list-style-type: none"> - Desktop - \$10 per unit - Notebook - \$5 per unit - Monitors - \$12 per unit - Televisions - \$15 to \$45 per unit - Printers - \$8 per unit 	<ul style="list-style-type: none"> - Desktop computers (central processing units, mouse, keyboards, cables) - Notebook computers (notebook, laptop, tablet PCs) - Monitors (includes CRTs and flat panel display) - Televisions (includes CRT, flat panel or rear projection) - Printers (includes laser, LED, ink jet, dot matrix, thermal, dye sublimation, copy, fax, print, etc) 	<p>Industry launched SWEEP (Saskatchewan Waste Electronic Equipment Program) to manage end-of-life electronics. Consumers pay an environmental fee that covers all costs for proper collection, transportation and management of the E-waste. Consumers can take WEEE products to 71 drop-off sites.</p>

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Appendix C Design for the Environment Requirement in Canada's Provincial Electronics Stewardship Programs

British Columbia's Electronic EPR Regulatory requirements

The requirements related to design-for-environment (DfE) in the Recycling Regulation are listed below:

Part 2, Section 5 (1) On receipt of a product stewardship plan submitted under section 4 [*submission of product stewardship plan*], the director may approve the plan if the director is satisfied that (c) the plan adequately provides for (vii) eliminating or reducing the environmental impacts of a product throughout the product's life cycle, and (viii) the management of the product in adherence to the order of preference in the pollution prevention hierarchy.

(3) For the purposes of subsection (1) (c) (viii), the pollution prevention hierarchy is as follows in descending order of preference, such that pollution prevention is not undertaken at one level unless or until all feasible opportunities for pollution prevention at a higher level have been taken: (a) reduce the environmental impact of producing the product by eliminating toxic components and increasing energy and resource efficiency; (b) redesign the product to improve reusability or recyclability; (c) eliminate or reduce the generation of unused portions of a product that is consumable; (d) reuse the product; (e) recycle the product; (f) recover material or energy from the product; (g) otherwise dispose of the waste from the product in compliance with the Act.

Annual report - Section 8 (1) On or before July 1 in each year, a producer must submit a report documenting (c) efforts taken by or on behalf of the producer to reduce environmental impacts throughout the product life cycle and to increase reusability or recyclability at the end of the life cycle; (d) a description of how the recovered product was managed in accordance with the pollution prevention hierarchy.

Ontario's WEEE Program Plan requirements

The requirements related to DfE are:

5.9.2 Reduction Targets

'Designing for the Environment' is an initiative undertaken by the electronics industry to improve the environmental performance of their products and activities. Under this Program, Ontario Electronic Stewardship (OES) members have committed to making improvement efforts in the areas of product design, materials and construction of products. The EPSC Design for the Environment Report can be found in Appendix 11.

In addition to a number of international design initiatives adopted by EEE manufacturers at the global level, these efforts are further encouraged by other factors. Product design and manufacture of obligated products are constantly being renewed by competitive pressures, as well as through federal, provincial and international regulations and standards. Manufacturers of EEE are constantly reviewing the use of substances of concern, and redesigning products to conform to tightening international standards and regulations, as well as to keep pace in a highly competitive market.

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The underlying driver of these activities is reduction in:

- The toxicity of materials
- The redesign of products for improved reusability or recycling
- The design of products and packaging to reduce waste occurring in the life cycle of those products, where this can be accomplished while meeting increasing performance requirements and consumer demands
- The impact on the environment and human health through the product life cycle, from design to EOL management.

The OES Program will report on OES members’ “Designing for the Environment” initiatives as part of its annual reporting requirements to the WDO. For further information on the type of reporting that is possible, please see the report on DfE that was prepared by EPSC²³. This report will be updated regularly by EPSC and will be a reference for OES when reporting to the WDO.

Nova Scotia’s Solid Waste-Resource Management Regulations requirements

Nova Scotia’s Electronic Products Stewardship Program Regulation requires that:

- 180 (1)** A brand owner who operates an electronic product stewardship program shall, on or before June 30 of each year or on or before the date set by the Administrator of the electronic product stewardship program, inform the Administrator in writing of the total quantity of electronic products collected.
- (2)** A brand owner who operates an electronic product stewardship program shall, upon request in writing from the Minister, provide the Minister with any information about their electronic product stewardship program, including any of the following:
- (a) the types of processes used to reuse and recycle the electronic products and their components
 - (b) the location of return collection facilities for electronic products
 - (c) the location of any long-term containment or final treatment and processing facilities for electronic products
 - (d) records showing that the program adheres to established vendor qualification standards or information demonstrating that the electronic products collected were managed in a manner that employs environmental and human health and safety standards meeting or exceeding applicable federal, Provincial, and local regulations
 - (e) efforts made to improve the environmental design of the brand owner’s electronic products

²³ www.epsc.ca/dfe/

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Appendix D Product Expandability Standards – Bluetooth, USB and DLNA

Bluetooth

Bluetooth wireless technology is a short-range communications technology intended to replace the cables connecting portable and/or fixed devices while maintaining high levels of security. The key features of Bluetooth technology are robustness, low power, and low cost. Bluetooth specifications define a uniform structure for a wide range of devices to connect and communicate with each other. Bluetooth technology is designed to allow collaboration between differing industries such as the computing, mobile phone and automotive markets. More than 2 billion Bluetooth-enabled devices have been shipped, including more than 50% of mobile phones worldwide, thereby establishing Bluetooth as the standard for usability and wireless connectivity for the majority of consumers globally.

The Bluetooth Special Interest Group (SIG)²⁴ comprises more than 9,000 member companies. Any company that incorporates Bluetooth wireless technology into products, using the technology to offer goods and services, or simply rebranding a product with Bluetooth technology, must become a member of the Bluetooth SIG. Bluetooth SIG members are key to the success of Bluetooth wireless technology because they influence its direction and development. As Bluetooth wireless technology is an open platform, all members of the Bluetooth SIG have permission to use Bluetooth wireless technology in their products and services.

There are three levels of Bluetooth SIG membership: Promoter, Associate and Adopter. Each level provides different benefits to the member company. Promoter companies are intensely engaged in the strategic and technical development of Bluetooth wireless technology. Associate members have the opportunity to work with other Associate and Promoter companies on enhancements to the core specification and profile specifications. Adopter members of the Bluetooth SIG may use published Bluetooth wireless specifications and Bluetooth trademarks, but do not have the opportunity to influence or gain early access to unpublished Bluetooth technology specifications. The majority of EPSC member companies are involved in some level of the SIG, as indicated in Table 1.

Highlights of Current Specifications:

Version 2.1 + EDR (Enhanced Data Rate), to advance its short-range wireless technology and make it easier for consumers to connect Bluetooth devices. This revision provides three key features for users:

- 1) **Ease of Connection:** Pairing Bluetooth devices is simplified by providing a more intuitive and consistent method. Pairing can be as simple as going to the menu of one device (a mobile phone, for example) and selecting “Add headset.” The device will find, establish and pair with the selected device automatically. Additionally, the standard supports Near Field Communication (NFC) Technology, whereby a user can hold two Bluetooth devices together in very close range to quickly pair them together.
- 2) **Lower Power Use:** Enhanced Power Optimization through a feature called Sniff Sub-rating increases battery life by up to five times in many devices like mice, keyboards, watches, home sensor networks and medical devices.
- 3) **Improved Security:** For pairing scenarios that require user interaction, eavesdropper protection makes a simple six-digit passkey stronger than a 16-digit alphanumeric character random PIN code. Improved pairing also offers "Man in the Middle" protection that, in reality, eliminates the possibility for an undetected middleman intercepting information.















²⁴ www.bluetooth.com/Bluetooth/SIG/

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What is next for Bluetooth?

Bluetooth low energy technology is a new design specification that takes the best parts of existing Bluetooth specifications and optimizes them for a new set of applications. Bluetooth low energy technology enables new classes of devices that can only be viable when an ultra low power radio technology, interoperable profiles and services are combined together to create an industry-wide technology platform. Bluetooth low energy technology connects everything to anything -- phones to watches, watches to shoes, shoes to web services, and web services to the home.

 Audio and Visual Total Products: 930	 Headset Total Products: 693	 Phone Total Products: 1708	 Unique Products Total Products: 501
 Automotive Total Products: 897	 Home Environment Total Products: 390	 Mobile Phone Accessory Total Products: 1092	 All Products Total Products: 5090
 Gaming Total Products: 38	 Input Devices Total Products: 134	 Office Equipment Total Products: 486	
 Handheld Total Products: 542	 Medical Total Products: 52	 Personal Computer Total Products: 586	
The products shown here represent the diversity of Bluetooth products on the market. ²⁵			

The core values of Bluetooth low energy technology are similar to existing Bluetooth core values:

- **Low Power** – The power consumption of Bluetooth technology has improved in every specification version – from interlaced page scanning in v1.2 to faster data rates in v2.0 and sniff sub-rating in v2.1 – to be the most power efficient standard for its applications. Bluetooth low energy technology dramatically improves energy efficiency when devices are connectable and discoverable, and also enables devices to send a small quantity of data very quickly from a disconnected state. These new low power features enable new market segments where there is a need to transmit only small amounts of data.
- **Low Cost** – Bluetooth technology has always been the lowest cost standard short-range wireless technology. There are no royalties or specification patents to worry about, and the specification is designed around mass production, using bulk CMOS technology. Bluetooth low energy technology will further reduce these costs by relaxing important specification parameters, and by reducing the implementation size significantly (approximately half the die size), which reduces the environmental resource impact as well.

²⁵ /www.bluetooth.com/Bluetooth/Products/Products/

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- **Worldwide** – Bluetooth technology can be used and sold in almost every country on the planet. As a result, it enables a single seamless market for wireless devices, creating a huge mass market, rather than country or regional specifications or devices.
- **Robust** – Bluetooth devices just work. Having a robust radio is essential when you are trying to gather a measurement from a sensor, or controlling something. Bluetooth technology has learnt that being robust is what consumers demand, and it is something that people now take for granted. Nothing has been compromised by Bluetooth's robust low energy technology.

The new specification has a number of features that make it very attractive, including:

- **Number of devices:** the active number of devices within a Bluetooth low energy network has been significantly increased to many thousands.
- **Web Service Integration:** the ability for small Bluetooth low energy wireless devices to send a small quantity of data to a web service is vital for a large number of use cases.
- **Fast Connection:** the time involved in making a connection, and sending data is very important to reduce battery life. A target of 3 ms was set, and has been met by Bluetooth low energy technology. Now a device can wake up, connect and send some application data, and then disconnect within 3 ms. this uses the lowest amount of energy, while providing the fastest possible transmission of event-based data.
- **Interoperable Sensors:** a consumer electronics-based specification will always favour interoperability over proprietary solutions. The profiles that have been created for health and fitness, medical and automation markets enable the creation of fully interoperable devices. This interoperability is tested via the unique Bluetooth qualification program.

The new markets that benefit from Bluetooth's low energy technology include – but are not limited to – watches, home, office, fitness and healthcare devices.

Universal Serial Bus (USB)²⁶

Created in 1995, Universal Serial Bus (USB) has become the standard connection for all PCs and PC peripherals today. USB provides an instant, no-hassle way to connect a variety of external devices such as mice, keyboards, scanners and printers to a PC. USB replaces all the different kinds of serial and parallel port connectors with one standardized plug and port combination. Key USB features include:

- **Hot-swapping:** this allows plugging in or removal of a peripheral without shutting down the PC. The PC automatically detects the peripheral and configures the necessary software.
- **Power Distribution:** USB distributes electrical power to many peripherals, acting as a bridge between the USB device and an AC adapter plugged into the wall. This allows for the USB device to be charged through the PC's electrical connection.
- **Data Flow:** USB connections allow data to flow both ways between the PC and peripheral. This means you can use your PC to control peripherals (and vice versa).

There are over 2 billion USB devices in the world, and although USB was designed for PCs, it has become commonplace on other devices such as PDAs and video game consoles. USB has become a standard requirement for expansion and project longevity in many environmental ecolabels around the world, including EPEAT and Blue Angel.

²⁶ www.usb.org/home

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USB Implementers Forum (USB-IF): This was established in 1995 to support and accelerate the market and consumer adoption of USB compliant peripherals. Today, the USB-IF has more than 900 member companies and has led the way in helping companies introduce hundreds of USB-compliant products to the market. The Forum facilitates the development of high-quality compatible USB peripherals (devices), as well as promoting the benefits of USB and the quality of products that have passed compliance testing. The majority of EPSC member companies are part of the USB Implementers Forum, as indicated in Table 5.

Highlights of Current USB specifications

USB 2.0: Finalized in 2001, USB 2.0 is a complete overhaul of the Universal Serial Bus input/output bus protocol, and allows much higher speeds than did the older USB 1.1 standard. USB 2.0 has broadened the range of external peripherals that can be used on a computer. It has a raw data rate at 480Mbps, and it is rated 40 times faster than its predecessor interface, USB 1.1, which tops at 12Mbps.

Wireless USB: With more than 2 billion legacy wired USB connections in the world today, USB is the de facto standard in the personal computing industry. Wireless USB is the new wireless extension to USB that combines the speed and security of wired technology with the ease-of-use of wireless technology. Wireless connectivity has enabled a convenience-filled mobile lifestyle for mobile computing users. Wireless USB will support robust high-speed wireless connectivity by utilizing the common WiMedia MB-OFDM Ultra-wideband (UWB) radio platform as developed by the WiMedia Alliance. UWB technology offers a solution for high bandwidth, low cost, low power consumption, and the physical size requirements of the next-generation consumer electronic devices.

What is next for USB?

USB 3.0: The third-generation Universal Serial Bus interconnect will transfer data at speeds up to 4.8Gbit/s, ten times faster than USB 2.0's 480MBit/s. It will be backwards-compatible with USB 2.0, which is backwards-compatible with the first USB 1.1 definition.

The USB 3.0 specification would be optimized for low power and improved protocol efficiency. The ports and cabling will be designed with both copper and optical cable capabilities, opening up the possibility of even higher speeds in the future.

Digital Living Network Alliance (DLNA)²⁷

Digital Living Network AllianceSM was launched in 2003, when a collection of companies from around the world agreed that they all made better products when those products were compatible. Today, more than 250 companies comprise DLNA; these member companies share a vision of a wired and wireless interoperable network of Personal Computers (PC), Consumer Electronics (CE) and mobile devices in the home that will enable a seamless environment for sharing and growing new digital media and content services.

DLNA Certified devices provide a consistent way to find, send, store, get, play and print digital content. All that is needed is a network – wired or wireless. DLNA Certified devices connect, discover and communicate with each other over a home network – like the one typically used for sharing broadband Internet. DLNA member companies seek to create new products and promote their ability to communicate by using open standards and widely available industry specifications. The member companies meet regularly to collaborate, share views and further the DLNA Interoperability Guidelines,

²⁷ www.dlna.org/home

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constantly refining the digital universe as new consumer needs, user scenarios, technologies and standards develop.

DLNA Interoperability Guidelines

DLNA published its first set of Interoperability Guidelines in June 2004 and the first set of DLNA Certified products began appearing in the market shortly thereafter.

The latest version of the DLNA Interoperability Guidelines, Version 1.5, was published in March 2006, and then expanded in October 2006. These guidelines enlarge the capabilities of a DLNA-defined network to include more home and mobile devices. They also include the specifications for link protection, to allow secure transmission of copyright-protected commercial digital content.

With the latest version of the DLNA Interoperability Guidelines, the DLNA defined capabilities for DLNA Certified devices to now include:

- Addition of mobile devices and printers
- An increase from two to 12 device classes supporting:
 - **Home Network Devices:** Digital Media Server, Digital Media Player, Digital Media Renderer, Digital Media Controller, Digital Media Printer
 - **Mobile Handheld Devices:** Mobile Digital Media Server, Mobile Digital Media Player, Mobile Digital Media Uploader, Mobile Digital Media Downloader, Mobile Digital Media Controller
 - **Home Infrastructure Devices:** Mobile Network Connectivity Function, Media Interoperability Unit
- Addition of link protection guidelines to protect commercial content
- Improvements to the architecture and protocol
- Addition of new media format profiles
- Addition of Real-time Transport Protocol (RTP) for streaming audio and video
- Quality of Service (QoS) extended across the entire DLNA network
- Support for the AVC (MPEG-4) video coding standard
- Support for Bluetooth technology

What's Next: The DLNA Roadmap

The DLNA member companies will continue to refine and expand the DLNA-defined capabilities to provide new and novel ways to connect and use digital devices. Some future capabilities that might be possible are:

- Connecting the digital devices in an automobile to a DLNA-defined network – that is a natural extension of the DLNA capabilities already defined for mobile devices so that users can enjoy their digital content literally on the road.
- Using not just the current sets of wired and wireless networking and connectivity technologies, but many other ways to network and connect that will enable more use cases in more diverse environments. With the adoption of IPv6, users will have the ability to use and access personal content, while outside the home just as if they were at home.

These are a few examples, and there will be many others. What we do know for certain is that the digital living defined by DLNA will continue to expand.