

Disable the cable

NO MATTER HOW LIBERATED we are by technology, cabling often holds us back. Nipping downstairs to the living room with your laptop so that you can watch *The Simpsons* while you work is a grand idea until you decide to log onto the Internet – at which point you need to plug in your modem. It would be nice to be able to leave the wires behind and enter the radio realm. Bluetooth is a new technology designed to do just that, and the signs are that it will catch on quickly.

The technology was originally developed as a short-range radio network for personal networking by a group of companies working in the mobile phone and computer markets. These founding members include Ericsson, IBM, Intel, Nokia and Toshiba. They were joined in December by 3Com (which made a success of the Palm Pilot), Lucent, Microsoft and Motorola.

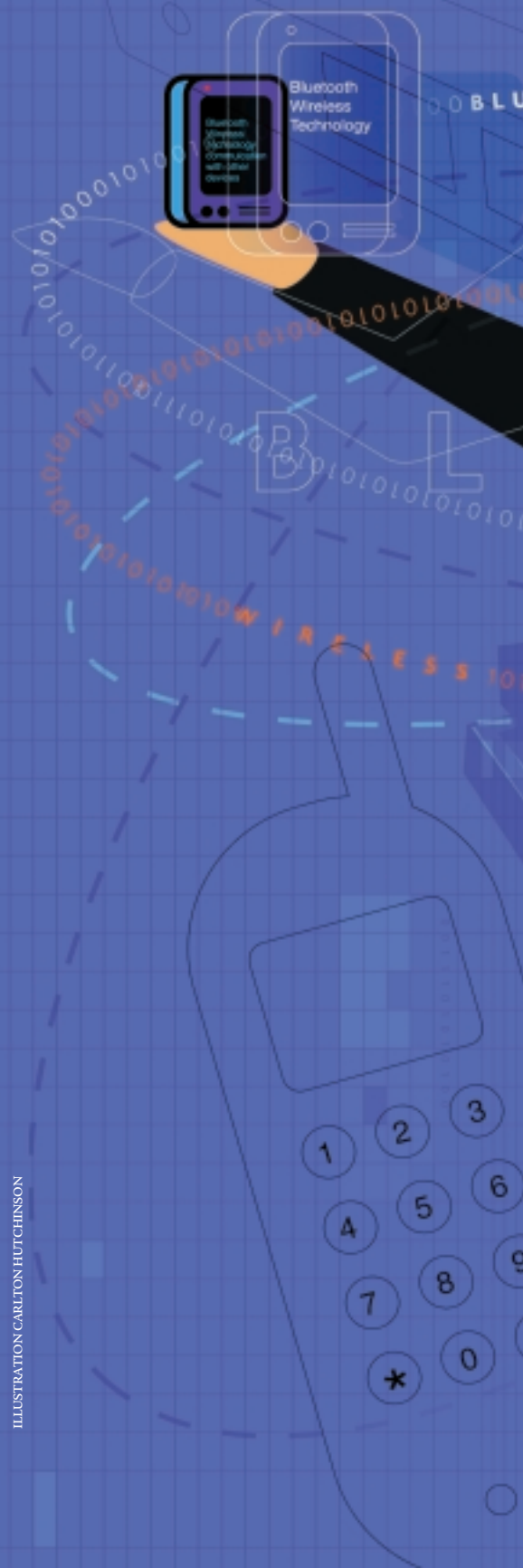
With a communication range of 10m (expandable to 10 times that by using more power in the transmission device) and a theoretical bandwidth of 1Mbit/sec, the technology was originally intended for communication between personal devices such as mobile phones and PDAs, rather than more widespread network communications – although many interested parties are hoping to stretch the technology further.

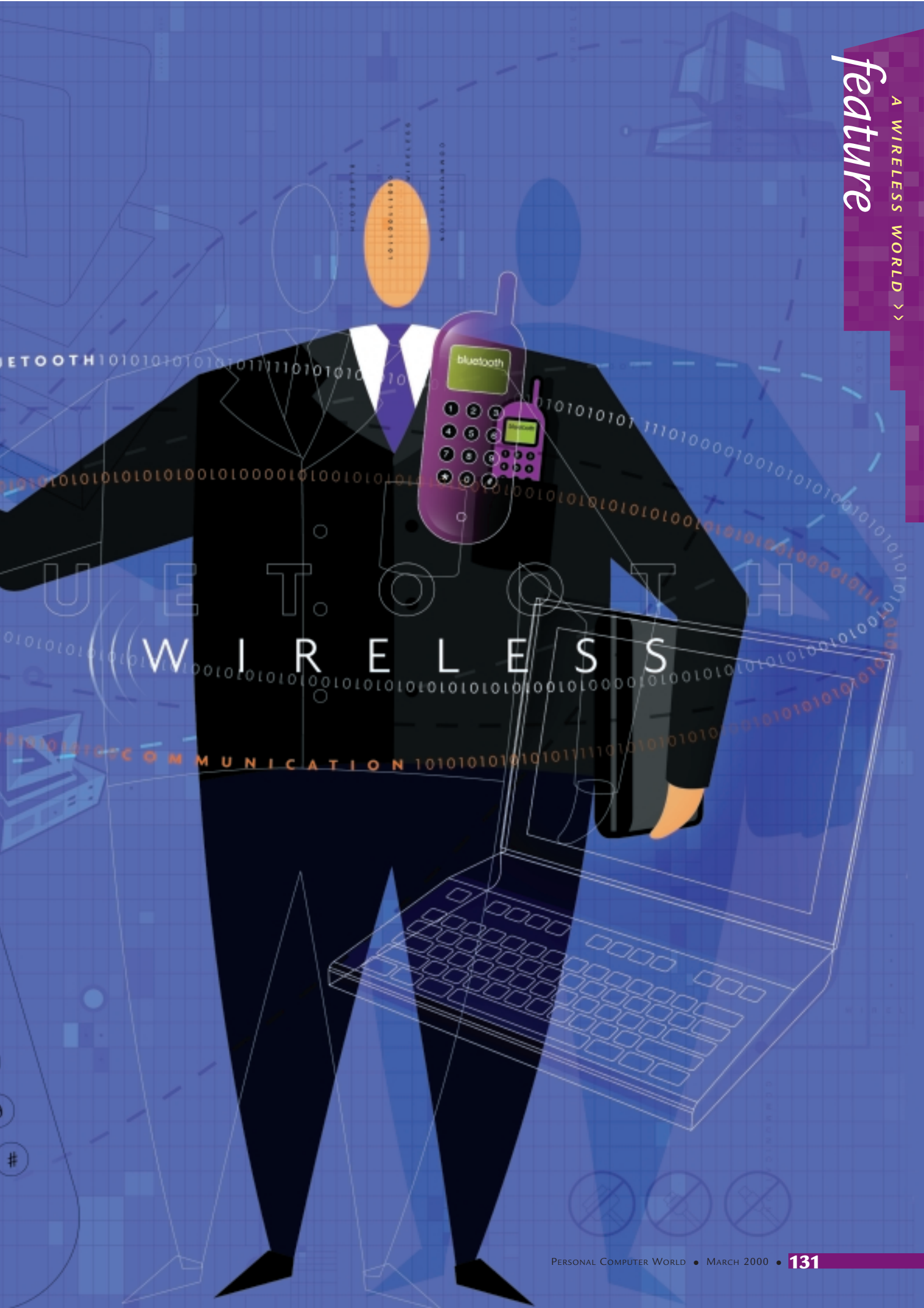
Bluetooth devices transmit and receive in the 2.4GHz radio range and the technology allows up to eight devices to be connected in a network called a Piconet. Devices, that listen on preset frequencies to see if any other devices are around, connect on a peer basis – this means any device can initiate the connection. One device becomes the master, which sets the frequency-hopping behaviour for the Piconet, and the rest become the slaves. Frequency hopping means the devices skip between transmitting and receiving on different frequencies in an agreed manner. This reduces the risk of interference from electrical devices such as noisy vacuum cleaner motors and serves to increase security, making it harder to eavesdrop on the communication between devices. Piconets can also connect to form larger networks called Scatternets.

The companies working on the Bluetooth standard have formed themselves into a group known as the Bluetooth Special Interest Group (or Bluetooth SIG, for short) and they have been working together since May 1998. This organisation also contains a number of sub-groups that focus on different aspects of the technology, such as the radio communication between devices; low-level software; interoperability testing; and marketing. There are also 14 profile working groups that work on Bluetooth applications, such as modems, headsets, mobile phones and Ethernet access.

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ILLUSTRATION CARLTON HUTCHINSON







Building a service industry

The limited scope of the initial Bluetooth specification has placed the emphasis on low-level hardware connectivity. Although there is support for some data formats such as the virtual calendar and contact manager data-exchange formats, developers who want to connect specific services using the technology may need to do a little work.

Both Sun Microsystems and a Microsoft-inspired consortium have been working on separate data-exchange technologies that could bring even more value to Bluetooth. Sun's Jini and Microsoft's Universal Plug and Play (UPnP) (the latter is

now being developed by a consortium of companies) are designed to let hardware or software services find and use each other over a network.

When a Jini or UPnP-enabled device is attached to a network on which other compatible devices are already established, it is instantly able to take advantage of any of the other devices' services, regardless of operating system or processing platform. When used in conjunction with a wireless network such as Bluetooth, the possibilities become very exciting.

Imagine, for example, walking into an office with your Bluetooth-enabled and

Jini-aware PDA. Your PDA would check the network for other devices, and find a network-enabled colour printer, a scanner, an independent storage device, a PC running a contact database, and a colour projector that were all Jini-compatible. The two technologies working together would let you use any of the other services. You could scan photographs on the scanner straight into software on your PDA, fold them into an existing presentation on your device, print copies of it to the network printer and then use the projector to display it – all without plugging anything in

or trying to establish any manual network connections.

That's the idea, anyway. The first big wave of Jini-based devices is still months away, and UPnP technology is still being developed. A third technology, called Salutation, is already out there, but has received less attention. These technologies still have to be integrated with Bluetooth, and discussions between the various parties are embryonic. However, the furthest advanced in terms of Bluetooth integration appears to be Salutation.

www.jini.org
www.upnp.org
www.salutation.org

Bluetooth will start out as an option in mobile phones, but it is planned to later make it a mandatory addition to new handsets. As the technology takes off, it will also appear in devices such as PDAs, headsets and digital cameras.

One of the biggest factors influencing the speed of Bluetooth adoption will be the price, according to Mike Reynolds, senior consultant at technology think-tank Scientific Generics. He explains that companies pushing the Bluetooth standard are targeting any device which uses a type of microchip called an application-specific integrated circuit (ASIC). These are designed to do a single task very quickly, such as compress images in a digital camera. The manufacturers argue that integrating Bluetooth into these types of devices will only add around £3 to their price.

But Richard Bisset, product marketing director at semiconductor design company Atmel, a company that is designing Bluetooth-compatible chips, isn't convinced. He argues that £3 is the sweet spot many manufacturers like to predict for Bluetooth, as it is the price point at which the technology will become ubiquitous, but the industry is a long way from hitting this critical point. Bisset believes that real figures at present are hovering around £9, although the exact cost will depend on the nature of the device and the volume of production. Atmel's price range for up to one million Bluetooth chips hovers between £8-£11 per unit – a significant premium to pay on sub-£65 devices.

As with any new technology, the take-up of Bluetooth will be driven by the applications it can be used for, and Reynolds believes that the

development of Bluetooth applications will be divided into three generations. The first phase will cover the areas originally intended by the Bluetooth SIG – telephones and possibly PDAs. Being able to use a mobile telephone with a headset separate to the base unit would create truly hands-free mobile phones. Also, connecting to the Internet via a mobile phone from a PDA without using wires will definitely appeal to PDA users fed up with attaching cables between devices just to pick up email.

Ericsson, one of the founding members of the Bluetooth SIG, has already made moves in these areas. At US trade show Comdex Fall, held last November, it announced a Bluetooth headset, which will be available to consumers in June this year. It's a light device that connects to a cellular phone through an adaptor. A little later in the year, the first Ericsson phones will ship with built-in Bluetooth compatibility.

The second generation of tools, says Reynolds, will do away with cabling for attaching devices to desktop and laptop PCs. Reynolds argues that solving customers' cabling problems is a major technical support overhead for PC vendors. 'If they can get everything talking over radiowaves, then their margins will go up because their support costs will go down,' he said.

It would also make computing a lot neater. Not having to hook your printer, scanner, modem, keyboard, speakers or mouse to your computer via cables would help to get rid of the spaghetti at the back of your desk, and enable you to rearrange your desk without getting down

Other technologies for a wire-free world

Bluetooth is far from the only close-range wireless communication technology on the market. Here are some of the others:

IrDA

Infra-red technology provides line-of-sight connectivity to systems up to one metre apart (the IrDA website says two metres can be reached). The data-transmission speeds range from 9600Kbits/sec to 4Mbits/sec depending on cost.

IrDA Data, released in 1994, focuses on two-way data transmission between, say, a mobile phone and a PC, while IrDA Control focuses on control-oriented devices such as joysticks.

Disadvantages to IrDA are that it needs two devices to be pointing at each other to work, making it less intuitive. Scientific Generics' Mike Reynolds argues there have been few formal processes to guarantee that different IrDA devices will be 100 per cent interoperable, which he says has hindered its take-up.

www.irda.org

OpenAir

Developed by wireless LAN vendor Proxim, this proprietary technology operates in the 2.4GHz band, and offers 15 separate 1.6Mbits/sec channels for the use of separate networks in the same space.

www.proxim.com

802.11 and 802.11B

802.11 was developed by the IEEE standards body, and approved back in 1997. It operates at 2Mbits/sec. The newer version, 802.11B, offers a higher throughput. Apple uses it for its Airport wireless LAN technology, which provides a hefty 11Mbits/sec bandwidth.

www.ieee.org

HomeRF

The HomeRF technology has a 50m range and uses a radio beacon for connectivity. Frequency hopping at 50 hops per second, it operates in the 2.4GHz band and can run at up to 2Mbits/sec. Derived from the DECT cordless telephone standard,

it supports up to six voice conversations, and a Shared Wireless Access Protocol (SWAP) Home RF network can support 127 devices.

www.homerf.org

HiperLAN

HiperLAN Type 1 was ratified in 1996. It works in the 5GHz range, providing up to 23Mbits/sec data throughput and has a 10-17m range in most indoor environments.

A wireless version called HiperLAN 2 for radio ATM is under development, as is a wireless local loop protocol called HiperAccess and a wireless point-to-point version called HiperLink.

www.hiperlan.com

on your hands and knees to unravel a bird's nest of cables. Also, imagine being able to download images from a digital camera just by having it in the same room as your PC!

In its third generation, possible applications are more outlandish. Reynolds argues that once the pricing for Bluetooth chips reaches the right level, the technology could find its way into anything that could benefit from communicating. Examples could be washing machines that notify engineers to get a part in stock. 'There are already large items of equipment such as cranes which have mobile phones built in that already do that,' he said. Your washing machine could send an email via your PC, or digital television.

Other examples of Bluetooth applications include smart cards that hold your personal data and exchange them with Bluetooth-enabled units as you walk past. Such systems could be used to digitise passport and air ticket information so your passage through an airport would be much quicker. There has been talk about virtual money as well - Bluetooth-enabled credit cards or electronic cash cards that communicate with compatible point-of-sale terminals.

Synchronising your PDA calendar with your desktop personal information manager would be much easier without all those cables, while Bluetooth-enabled MP3 players would be a dream. How about grabbing your Palm Pilot or Psion, finding a contact and having the PDA tell your telephone to dial the number for you? If you had a Bluetooth-enabled headset, you could even

leave your phone in your pocket or bag and make the call without even looking at it.

This last suggestion highlights the voice facilities within Bluetooth. Besides eliminating cables, this is the area that holds most interest for many Bluetooth vendors because it is what the technology was originally designed to do.

Andres Edlund, who deals with the marketing of Bluetooth technology for Ericsson, explains that Bluetooth can support from one to three simultaneous voice calls with various grades of protection against interference. Also, if a voice call is being used in a Bluetooth Piconet while data is also being transmitted, he says, Bluetooth can gracefully decay the quality of a voice call to make room for the extra volume of data.

Nevertheless, there are limitations. Bluetooth's theoretical maximum bandwidth is 1Mbit/sec and the communications overhead leaves you a real asymmetric bandwidth of just 721Kbits/sec with a 57.6Kbits/sec return route. This drops to 432.6Kbits/sec in a symmetric link. This is slow compared to even basic Ethernet technology, highlighting the fact that it wasn't originally designed for heavyweight LAN applications, but for personal networks. However, the SIG is discussing higher-bandwidth implementations for Bluetooth 2.0, and rumours suggest a possible 2Mbits/sec implementation.

For Bluetooth to become universal the price needs to come in at an affordable level. This is the perennial problem for new technologies, but the heavyweight industry support for Bluetooth makes it likely to succeed.

