

Get smart

Picture waking up as your curtains slide open and the room lights slowly brighten. When your feet touch the floor, sensors on the wall detect the movement and tell your coffee machine to turn on. After you shower, your car's heater switches itself on to melt away any overnight ice build-up. When you brush your teeth, your toothbrush records the motions and offers suggestions. Your watch buzzes, alerting you of a traffic jam on your way to work and suggesting an alternate route. You get in your car, and as you approach the office, a map of free parking spots flashes up on your windscreen, and allows you to reserve one. That would be your morning routine in an Internet of Things.

The "Internet of Things" refers to a system of devices that use sensors to gather and analyse information about their environment, then communicate it to each other to inform and improve their performance. The trend promises to stretch from consumer electronics to household appliances to cars and industrial infrastructure. It's still anyone's guess how large the industry will grow, and both companies and researchers have been guessing. Systems-maker [Cisco](#) (US: CSCO) estimates there will be 50bn connected devices in 2020, from 10bn today, and its CEO John Chambers expects there to be \$14 trillion (£8.4trn) in profits up for grabs. A more conservative estimate from tech research firm Gartner is 26bn devices, which could have a total economic impact of \$1.9 trillion through gains such as cost savings and improved productivity.

However, this isn't a new phenomenon. The term "Internet of Things" was coined in 1999 by British tech-guru Kevin Ashton, and South Korea's LG launched the first Internet-connected fridge in 2000. So why the sudden upsurge in popularity? The reason is that technological limitations and societal constraints have fallen by the wayside. Smartphones, which can act as "always-on" remote controls for connected devices, are now broadly available. Moreover, data can be stored remotely in the cloud, allowing complex, off-site number crunching and freeing households and businesses from bandwidth limits. And the price of hardware has fallen substantially, making it less expensive to manufacture smart devices.

Companies across many industries and sectors stand to gain from the burgeoning trend. Smart devices will need microchips from designers such as [Arm](#) (ARM), Imagination (IMG) and [Intel](#) (US: INTC). The Internet of Things will require sturdy, secure and reliable server infrastructure from companies like Cisco, [IBM](#) (US: IBM) and [Oracle](#) (US: ORCL), and data centre providers such as [Telecity](#) (TCY) could see a demand bump as companies crave more data space.

There are other, less obvious beneficiaries. [Laird](#) (LRD), which makes mobile antennae as well as casings that protect electronic components from heat and electromagnetic waves, and [Spirent](#) (SPT), which offers wireless and mobile network testing, also stand to gain. Both software and hardware businesses may see bumper sales in the next few years - research outfit IDC expects technology and services revenue to rise to \$7.3 trillion by 2017, suggesting an almost 9 per cent compounded annual growth rate.

As for industry winners, advertisers and marketers will relish access to web-connected consumers with multiple screens in their homes, as well as interactive billboards and bus stops. But the largest gains are likely to be in the industrial and governmental space. Traffic and waste management systems may be able to analyse customer habits and reward or penalise them, smart electricity grids could adjust rates depending on energy usage, intelligent water systems and oil and gas pipelines can sound an alert if there are leaks, and Internet-managed factories and assembly lines should improve business efficiency, cut costs and reduce energy use.

A recent Arm-sponsored survey of 779 executives in 19 industries worldwide, conducted by The Economist, demonstrates the Internet of Things is more than a pipe dream. Just under a quarter of interviewees expect it to alter their business model or strategy, and about a third believe it will lead to new iterations of their products and services. Moreover, 95 per cent say their business will use the technology in 3 years' time, and around 60 per cent believe they will fall behind if they don't integrate the technology into their business. Over two-thirds have already made Internet of Things investments, and 29 per cent said they increased investment in the space by over 10 per cent year-on-year. The consensus seems to be that the Internet of Things will drive new sources of revenue and make business operations more efficient, allowing companies to both improve profits and cut costs. Only 6 per cent of the leaders thought it was hype.

But the Internet of Things may tail off in the long term, though. Connected hardware will likely follow smartphones and become commoditised, with sales of low-end varieties outpacing more expensive ones. Margins may fall as devices become easier to replicate, and profit opportunities may increasingly be found in software and service provision, which has been the case with personal computers - players like [Microsoft](#) (US: MSFT), [Google](#) (US: GOOG) and Oracle now rule that space.

The following businesses deal in both software and hardware, and run the gamut from microchip-makers to agriculture companies.

Microchip designers

Microchip giant Intel plans to provide a suite of products to enable the Internet of Things, including microprocessors, security and analytical software, and a development platform. It also wants to address the issue of connecting existing devices to the cloud and enabling them to communicate with new devices. Intel's digital security business, McAfee, and embedded device subsidiary, Wind River Systems, give it a strong stake in this emerging technology, as it can offer microprocessors that give devices their intelligence, as well as smart and secure applications.

In fact, Intel released a low-power, miniature, all-in-one chip in September tailored for the Internet of Things, and recently launched the Intelligence Device Platform, offering programmers a way to design and develop connected objects. Also, the company's new CEO seems keen to focus Intel on areas it has an advantage in, which promises to improve its margins and returns.

Other beneficiaries include Arm and Imagination Technologies, which license out microchip designs then collect a royalty fee for every chip shipped. They should see increased demand for microprocessors, graphics, audio, video and radio microchips. Arm's chip designs are used in the majority of the world's smartphones and tablets, and Imagination counts [Apple](#) (US:AAPL) and Google among its customers, so both have strong connections to hardware companies.

Arm's stock price, which has soared 1,000% in five years, may reflect investors' bets on the Internet of Things. The company continues to impress, posting double-digit revenues and profit growth last quarter, despite a slowdown in high-end smartphone sales. It has already made moves into the microcontroller, server and home appliance markets – 42 per cent of the 10bn Arm-based chips shipped last year were for products other than smartphones and tablets. However, its shares are far from cheap, trading at 36 times broker JPMorgan's earnings estimates for 2014.

Imagination has also taken strides, selling its MIPS processors for use in low-power wearable devices and connected gadgets. So too has CSR (CSR) – its Bluetooth chip powers Nike's Fuelband, a wearable fitness tracker, and its new Bluetooth Smart microchip offers a low-cost, easy-to-integrate way to connect devices to a single interface on a smartphone or tablet. Although CSR's shares have soared 78 per cent in the past year, JPMorgan believes they could double over the next 2-3 years as Bluetooth Smart could be the "major connective technology" of the Internet of Things. The broker thinks that product alone could drive sales of \$500m in 2017, generating company sales of \$1.2bn, from just over \$1bn in 2012.

In contrast, semiconductor-manufacturer [Wolfson Microelectronics](#) (WLF) just recorded its fifth consecutive year of losses, partly because it was slower than audio-microchip specialist [Qualcomm](#) (US: QCOM) to address the 4G technology market. Qualcomm wants to build routers that can manage a home full of connected devices, offering both content storage and computing power. It also intends to connect audio equipment and Internet music services from different brands, allowing them to communicate with each other. It bought chip-maker Atheros Communications for \$3.1bn in 2011, allowing it to offer both Wi-Fi chips and cellular expertise, and the investment appears to have paid off so far.

The lesson here might be that it is important for businesses to be flexible and address new markets. Those that don't, and are in the hardware business, may find themselves struggling.

Systems and infrastructure providers

Providers of internet-related infrastructure, such as cloud data storage or fibre optic cable networks, should stand to benefit as more and more things are connected to the internet.

That will certainly be systems titan Cisco's hope. The company reported revenues of \$11.3bn last quarter, an 8 per cent year-on-year decline, and expects sales to drop 6-8 per cent this quarter. Moreover, its net income was \$1.43bn, down from \$3.14bn a year ago. Cisco is betting, or perhaps praying, that as cars, appliances and devices get smart, the demand for its expertise will rise and service sales will grow from 20 to 30 per cent of its overall revenues. It plans to help various businesses, including manufacturers, energy and transport companies, to monitor their workers, equipment and production.

Oracle, a big player in both the hardware and software spaces, is hoping to reignite interest in its Java programming platform, which has fallen out of favour. It wants to create Internet of Things services that are continuously upgraded, predicting that service delivery will be more profitable than embedded systems. It plans to combine Java, data storage and analytics, and extreme performance hardware, to create a comprehensive ecosystem.

It's not only billion-dollar businesses that will have a role to play. Aim-listed [iomart](#) (IOM) was one of the first UK companies to provide cloud hosting services in 2009. It has grown organically and via acquisitions to become a leading provider of data hosting and cloud computing services to small- and medium-sized British businesses – exactly the kinds of companies that will be building the next generation of web-connected technologies. While there is little doubt about the long-term shift toward cloud-based data storage, shares in Iomart trade on a punchy 25 times adjusted earnings for the current year, and as such we rate the shares a 'hold'. In a warning shot to the sector, shares in

the more traditional computer data centre provider Telecity tumbled to a two-year low in February after the company issued tepid forward guidance. Trading on 18 times recently downgraded forward earning estimates, we also rate the shares 'hold'.

KCOM Group (KCOM) and **CityFibre** (CFHL) are other companies set to capitalise on the need for more internet-related infrastructure over time. Both install and provide fibre optic broadband for service providers, mobile operators, the public sector and businesses in tier 2 and 3 UK cities such as Hull, York and Peterborough, where there is (or was) a shortage of high-quality internet networks. Of the two, KCOM looks the safer bet: it reliably spins out cash and trades on 13 times forward earnings. CityFibre listed on Aim in January and is expected to be loss-making until 2016 or 2017.

Product makers

Investing directly in product developers is often a high-risk, high-reward venture. A hit product can result in huge gains for company backers but often the best, most innovative products are created by private, nimble start-ups, or large corporate behemoths with fat R&D budgets where an isolated product success is unlikely to move the dial much.

Consumer electronics and appliance-maker **Samsung** (SK:KSC) offers a Smart Home platform that allows you to control and manage home devices through a single application on your smartphone, tablet or TV. It also has its own operating system, Tizen, which could run on and connect all its devices. Given its presence in appliances, it's unsurprising that Samsung wants to connect fridges and washing machines with TVs and watches. Although Samsung now faces a quarter-on-quarter revenue decline, JPMorgan highlights its healthy financials, diversified product portfolio and dominant market positions, and expects it to grow through mergers and acquisitions outside the IT sector.is

Set top box developer **Amino** (AMO) has a connected home TV hub system – or media gateway – but the jury is still out whether it can compete with the scale of Samsung. Analyst Andrew Darley from small-cap specialist broker finnCap demoed the system at a trade show last year (it's coming again to Olympia in March) and wrote the following observations.

“If you are out of the house and your alarm goes off, your system will alert you and provide connected CCTV views inside your house. If your aged mother is normally ruthlessly routine in visiting the bathroom and making a cup of tea by 9am, and neither have yet happened by 10am, her system will message you. If the movement sensor spots no-one in the house since Friday morning and it's 4am on Saturday, it can be set to turn the heating off until Sunday afternoon, as you are probably away for the weekend; or if it doesn't do that you can log in remotely and turn the heating off anyway. The intelligent deployment of existing technology in exciting ways is not new – but devices like Amino's hybrid set top boxes and their further apps are clearly hubs for further whole home systems.”

To that end, Amino's shares look attractive trading on just 8.5 times earnings net of cash, and offer a pleasing 4.4 per cent forward yield for the coming financial year.

Another product in the early stages of adoption is smart lighting, as rising sales of Hue LED bulbs from market leader Philips (NYSE: PHG) attest. The electronics-maker is also releasing a baby monitor with room lighting controls and a built-in camera, connected by 3G and Wi-Fi, and a smart air purifier that is controllable via smartphone. But its Hue bulbs have received much of the attention. They can be controlled from anywhere using a smartphone app, can create any colour you wish, can be set on a timer to make it appear as if someone is in the house when you're on holiday, and benefit from simple installation.

Aim-listed **PhotonStar** LED Group (PSL) has a competing product, Halcyon, which is billed as a “retrofit wireless LED lighting solution” that delivers “healthy Circadian lighting”. Circadian lighting changes throughout the day to emulate the changing colour and intensity of natural daylight, and is thought to provide some health benefits. Trading has been mediocre this past year for PhotonStar's other LED products but the Halcyon product range is due for full commercial launch this year.

Chip designer **Toumaz** (TMZ) has likewise suffered from slower trading recently and hopes to improve things with sales of a new smart product, SensiumVitals. It is a small, disposable, wireless plaster bandage that attaches to a hospital patient's chest and monitors the vital signs of general care patients. Vital signs are communicated in real time to a nurse station or any web-connected device, allowing for early intervention, as current hospital practice involves the majority of patients having their vital signs taken once every four to eight hours.

Toumaz received its first commercial order for SensiumVitals in October 2013 and the first UK trial of the product has just commenced. Wide adoption of new medical technologies is traditionally sluggish, however, so for the foreseeable future the majority of Toumaz's sales will come from its audio chip division. The company sells its chip designs to digital radio companies, speaker manufacturers, and music streaming service Spotify.

Smartening everything in people's homes carries risks and complications, however. People expect durable goods to last for years, and smart appliances will need software updates to ensure they continue to function and remain secure against hacking. In the case of smart cars, failure to update software could be a serious safety risk.

Providing that service will be costly and time-consuming to companies, and is unlikely to make them money. Moreover, it's in companies' interests for consumers to replace defunct products with new-and-improved versions. But for smart devices to work, their producers will have to commit to a lifetime of updates, or make them cheap enough to replace every few years.

Connectivity

The ability to communicate quickly, safely and seamlessly between smart devices and the network is of overriding importance to the Internet of Things. It's also critical to be able to access the devices or data using any medium a consumer wishes, be it a smartphone, tablet or laptop.

Mobile carriers are well-placed to benefit, as hordes of data-hungry devices demand access to 3G and 4G networks. Telecoms titan [AT&T](#) (US: T) has pre-emptively paired up with PC-giant IBM to address the trend, which is itself catering to the Internet of Things with a new tool called Node-RED, a simple point-and-click interface that allows the development of apps that link to physical devices. In the partnership, IBM manages, secures and analyses data from mobile devices, while AT&T collects, organises, stores and sends data to devices and applications. AT&T has also convinced carmakers Audi and Tesla to connect future cars to its US network. However, investing right now might not be prudent. AT&T is competing in a cutthroat wireless market against the likes of T-Mobile and Verizon, who have forced it to cut its prices. It's also not growing especially fast - JPMorgan expects EPS to grow 6.4 per cent this year, to \$2.66.

There are also serious drawbacks to a telco-led Internet of Things. Carriers offer limited, if not non-existent, cellular service in many areas, and consumers could struggle greatly if their car, washing machine and home security system are tied to one carrier for the next decade. If they move house, drive over a border or even go through a tunnel without carrier service, a host of problems could occur.

Still, there are some promising UK players. Aim-listed [Telit Communications](#) (TCM) claims to be at the forefront of "machine-to-machine communication". It has been advancing a wide range of related technologies for the past two decades and is now raking in money mainly from sales of wireless communication software and hardware. The company has offices in Israel, London, Italy and South Korea and has over 5,000 customers worldwide. As you'd expect, it's been growing rapidly of late: revenues in the year ended 31 December 2013 rose by nearly a fifth to \$244m (£146m). Shares in Telit represent one of the most direct ways to invest in the Internet of Things on Aim and, having more than doubled in value during the past six months alone, the shares now trade on 20 times Canaccord Genuity's earnings estimates for 2014 - not overly excessive in our opinion, however, given the company's growth prospects. There could still be plenty of upside on the table from here.

Ensuring smart devices are secure from cyber attacks and data theft will undoubtedly become increasingly important as they proliferate. To that end, security software group Intercede (IGP) is already an established player in the secure ID space; they sell software to large companies and governments who can issue staff with secure building pass cards, computer logins and access to smartphones. Yet Intercede is also hoping to leverage its intellectual property to expand into the Internet of Things. Chief executive Richard Parris says it promises to be "a very large market for Intercede to exploit in both the medium and long term".

Wireless equipment tester [Anite](#) (AIE) offers another indirect play on the rise of connected devices but its heavy exposure to the intricacies of the mobile sector puts us off somewhat. Long-term drivers are encouraging but an October profit warning revealed the lumpy nature of orders in Anite's handset testing division, which accounts for the majority of sales. Network testing is growing fast but the trajectory of Anite's shares over the next year or two will mostly depend on a recovery in mobile testing.

Applied Technology

The Internet of Things is unlikely to be limited to people having talking devices stuck to their walls and strapped to their bodies. It also has great potential outside the traditional technology industries.

[Monsanto](#) (US: MON), a world leader in agricultural biotechnology, plants sensors and connected devices in farmers' fields, allowing them to create automated irrigation schedules and programme pesticide spraying. It also offers farmers data on soil and moisture variation in each of their fields, and uses GPS devices on tractors to track where and how deep seeds are planted. In an industry often seen as bucolic, that is quite a development. Monsanto then sells the information to other farmers, and aggregates the information and sells it to other organisations. Global population growth promises an ever-increasing appetite for crops, and Monsanto is well-placed to gain from that. It views data science as a \$20bn opportunity - for instance, it believes that corn farmers are missing out on 30-50 bushels in their fields.

Another flag carrier for the Internet of Things is [General Electric](#) (US: GE), although it prefers the label "Industrial Internet". It enables companies to collect and analyse data from industrial sensors, and combine it with other information stored in the cloud. The company's current applications include improving jet fuel usage by cutting costs and CO2 emissions, integrating bed assignments, patient flow and equipment management in hospitals, and allowing

utilities and power plants to monitor and manage their grids and equipment more intelligently, letting them respond better to outages.

General Electric estimates it can eliminate \$150bn in waste across major industries, including the \$22bn wasted annually by commercial airlines due to flight delays and poor fuel consumption. It's working with several of the big players in the space, combining its knowledge of industries and equipment with Intel's processors and network management tools, AT&T's Internet service, and Cisco's data analysis software.

IC View: The Internet of Things has an enormous variety of applications, and transcends traditional industry lines. It also raises a raft of potential problems. A major one is security – Cisco claims cyber attacks rose 14 per cent last year, to their highest level since 2000. Another is anti-competitive strategies. The Internet grew without major companies controlling its spread, but this time around dozens of billion-dollar businesses are eager to have their platform universally adopted, so they can reap the benefits of scale. That means there will be a variety of communication standards – Bluetooth, 3G, Wi-Fi and many more – so devices may not be able to communicate, and customers will be stuck with a segmented home, rather than a connected one. Hand-in-hand with that issue is the risk of an 'Internet of Smart Silos', as companies in different sectors may be reluctant to cooperate with one another. Also, increasing the complexity of home appliances and other devices may lower their reliability and longevity, and make them more susceptible to bugs and breakdowns. Perhaps some things are better kept simple.

It's tough at this stage to predict which companies and industries will benefit the most, and which will see more modest gains. Microchip designers stand to gain greatly if it turns out to be more than a fad, as do data, server and network providers. On the other hand, companies and investors can't afford to ignore this next big leap in the internet's development. Inflexible or slow adopting companies may well fall behind, as their rivals improve efficiency and get a better handle on costs thanks to new internet-enabled processes. As for investors, software bets seem likely to outperform hardware investments, as the latter is capital-intensive, more easily copied and vulnerable to price declines. Regardless, whether it crops up in agriculture or throws a spanner into manufacturing processes, we expect the Internet of Things to be a happy hunting ground for canny stockpickers.

Smart buy? Google's \$3.2bn Thermostat

Earlier this year Google agreed to pay \$3.2bn for Nest, a privately owned, four-year-old American start-up that makes smart gadgets for the home. It is a bold bet by the search giant on the "Internet of Things" and is the second largest deal in Google's history, behind its \$12.5bn Motorola acquisition in 2011 and ahead of the \$3.1bn it paid in 2007 for DoubleClick, the display advertising network.

Industry commentators gawked at the price but there's no question the deal rapidly accelerates Google's reach into hardware and connected devices, such as wearable technology Google Glass and recent acquisitions in robotics.

Nest's first and best-selling product is the \$250 Learning Thermostat, which is WiFi-enabled and aims to cut heating bills in homes and offices by monitoring heating preferences over time. It is fast becoming the poster-child for the internet of things – small, web-connected devices that use the Internet to become smarter and more efficient – and boasts beautifully designed hardware and software conceived by Tony Fadell, the creator of Apple's first iPod. The thermostat can be controlled remotely through a smartphone app; Mr Fadell has even described it as a "thermostat for the iPhone generation".

Nest has never revealed exact sales figures but it's rumoured to be shipping around a million units a year solely within the US. A UK launch is expected sometime in 2014.

Nest's second product, launched globally last year, is the \$130 Protect smoke alarm which "warns of possible fires in a soothing maternal voice", according to the Financial Times' technology correspondent Tim Bradshaw. It also sends smartphone notifications when it is running out of batteries and can be silenced with the wave of a hand. That's hardly revolutionary, but it fits in neatly with Nest's objective to "reinvent the unloved products that proliferate in our homes", notes Mr Fadell.

Only time will tell if Google's acquisition proves to be 'smart' one or not, but our hunch is that it will be. Much will depend on the progression of the wider internet of things market, whether Nest can keep significant market share amid fiercely growing competition, and if Apple's Tony Fadell has more intriguing products in the pipeline.

Google has also roped in car companies including General Motors and Audi to use Android in their future vehicles,

allowing information and entertainment apps on smartphones to run on car computers. The first fleet of Android cars is slated for release at the end of this year. Google's presence in a broad range of industries, including advertising, wearable technology and healthcare, and how its ventures could benefit from a more connected world, is a major reason we rate it as a buy.

The Internet Coke Machine

Few know it, but the origins of the Internet of Things can actually be traced back to 1982. Computer science students at Carnegie-Mellon University were fed up making the long walk to the department's Coke machine only to find it sold out of their favourite canned soft drink. So a group of them decided to rig up the vending machine with some hardware and software in order to be able to verify how many cans were still available from a remote location.

Today, the internet Coke machine has come full circle. [Coca-Cola\(US:KO\)](#) recently rolled out more than 2,000 web-connected soda vending machines across the United States and the United Kingdom, mainly in selected Burger King restaurants and movie theatres. Known as Freestyle machines, the self-service units are smart versions of your typical fountain drink dispenser, where users can select and dispense their own drink with the push of a button. The difference? They're all connected to the internet, so that Coca-Cola can track in real time what drinks people are making and how often – giving the company a huge amount of consumer data to play with. There's also more choice: a smarter tracking system means suppliers can re-fill the machines before they run too low on a certain product, allowing some of the machines to offer over 100 types of beverages.

In addition to the Freestyle machines, Bloomberg Businessweek reports the beverage giant has been testing 200 web-connected stand-alone vending machines in Texas, and plans to roll out tens of thousands more.

The Internet of Tripe

by finnCap technology analyst Andrew Darley

I don't like tripe, but if I did I would doubtless keep it in the fridge. Current press coverage suggests that if I subsequently ran out, my internet-enabled fridge would be able to either inform me or order some more, notwithstanding that in the act of finishing the packet of tripe I would doubtless be aware of my need for more already.

The thing is, apart from moving house, I've never bought a new fridge; from discussion around the office the replacement cycle for fridges is of the order of 10 to 15 years, never for functionality, but merely to replace a dead one. If I did buy one now, I wouldn't go for the one which told me what I already know – that I've run out of the stuff

I've just finished - and costs more (the management consultant of fridges, it could be said). Hence my frustration when conversations about the Internet of Things cite the "connected fridge", which is actually a load of old tripe and misses the point entirely.

The Internet of Things is about the intelligent deployment of existing technology in exciting new ways. That's nothing new in itself; the revolution is actually evolution, and has been well underway for years already. Your TV, phone and games console are already on the "internet of things" and are constantly reporting on your filthy habits, whether to Facebook, Google, Sky, or GCHQ.

What we do expect is growth in applications for such products as an obvious attempt to jumpstart replacement cycles.

Data volume growth will accelerate, and retail suppliers have most to gain from data mining, to attempt to attract further spend from us. Applications will be legion, and we may see my tripe levels monitored online for free – or my connected loo might suggest to my Sainsbury's iPad app that I order some more Andrex, but I sure ain't paying for that privilege either. The overarching certainty is that it is the infrastructure which is the only limit and will prove the better long-term investment, whether via an in-home enabler such as the media gateway developed by Amino*, or the internet infrastructure owner (CityFibre*, iomart).

*Indicates a corporate client