



Fact sheet – The Internet of Things (IoT)

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Part of the [Tranzinfo Hot Topics](#) series, this fact sheet offers a selection of material on **The Internet of Things**.

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Glossary

The Internet of Things (IoT)

"The term Internet of Things generally refers to scenarios where network connectivity and computing capability extends to objects, sensors and everyday items not normally considered computers, allowing these devices to generate, exchange and consume data with minimal human intervention. There is, however, no single, universal definition." [\(Internet Society, 2015\)](#)

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What it is

[What is the internet of things?](#)

Allaway, T, PwC Chair in Digital Economy, October 2015.

According to this infographic by Harbor Research and Postscapes, technology employed within the home is indeed expected to have the greatest revenue implications going forward. However the IoT will also have a role to play in health, transport, the creation of 'smart' cities and much, much more beyond.

[The Internet of Things: an overview](#)

Rose, K, Eldridge, S & Chapin, L, Internet Society, October 2015.

This overview document is designed to help the Internet Society community navigate the dialogue surrounding the Internet of Things in light of the competing predictions about its promises and perils. Five key IoT issue areas are examined to explore some of the most pressing challenges and questions related to the technology. These include issues such as security, privacy, interoperability and standards, emerging economies, and legal and regulatory issues.

[Digital ubiquity: how connections, sensors, and data are revolutionizing business](#)

Iansiti, M & Lakhani, K, *Harvard Business Review*, November 2014.

Adapting to ubiquitous digital connectivity is now essential to competitiveness in most sectors of our economy. We have seen that digital transformation is no traditional disruption scenario: the paradigm is not displacement and replacement but connectivity and recombination. Transactions are being digitized, data is being generated and analysed in new ways, and previously discrete objects, people, and activities are being connected. Incumbents can use their existing assets, dramatically increase their value, and defend against (or partner with) entrants.

[The "Internet of Things" is now: connecting the real economy](#)

Morgan Stanley, 2014.

While smartphones and the mobile internet saw the advent of applications for the consumer, we expect to see the pervasive integration of semiconductors, mobile communication, and Big Data/analytics propelling the Internet of Things into the wider economy. The two key drivers of IoT are: 1) price reduction and standardization of key hardware and software components; and 2) the level of integration with Big Data/Analytics, from which companies in various sectors can increase revenues and reduce inefficiencies.

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The Technology

[Open Connectivity Foundation brings massive scale to IoT ecosystem](#)

Press release, Open Connectivity Foundation, 19 February 2016.

Major industry leaders who are invested in the future of the Internet of Things, announced they will unify as the Open Connectivity Foundation (OCF), an entity whose goal will be to help unify IoT standards so that companies and developers can create IoT solutions and devices that work seamlessly together. Via cross-

industry collaboration, the OCF will work towards unlocking the massive opportunity of the future global IoT segment, accelerate industry innovation and help all developers and companies create solutions that map to a single, open IoT interoperability specification.

[Inside the Internet of Things: a primer on the technologies building the IoT.](#)

Holdowsky, J, Mahto, M, Raynor, ME & Cotteleer, MJ, Deloitte University Press, 2015. This document serves as a technical primer on some of the technologies that currently drive the IoT. Its structure follows that of the technologies that connect the stages of the Information Value Loop: sensors, networks, standards, augmented intelligence, and augmented behaviour.

[Systems computing challenges in the Internet of Things](#)

Alur, R, Berger, E, Drobni, A, Fix, L, Fu, K, Hager, G, Lopresti, D, Nahrstedt, K, Mynatt, E, Patel, S, Rexford, J, Stankovic, J & Zorn, B, Computing Community Consortium, 22 September 2015.

In this paper the authors argue that existing best practices in building robust and secure systems are insufficient to address the new challenges that IoT systems will present. Recommendations are made regarding investments in research areas that will help address inadequacies in existing systems, practices, tools, and policies. The goal of this white paper is to consider the core software, systems, and networking technology shifts created by the IoT trend and try to anticipate the major challenges such systems face in terms of usability, performance, security, and reliability.

[Wireless connectivity for the Internet of Things: one size does not fit all](#)

Reiter, G, Texas Instruments, 2014.

In the rapidly growing Internet of Things (IoT), applications from personal electronics to industrial machines and sensors are getting wirelessly connected to the Internet. This paper reviews the main wireless connectivity technologies in the market, discusses their key technical concepts and engineering tradeoffs and provides guidelines for selection of the right wireless technology for different applications.

[Data management for the Internet of Things](#)

Krensky, P, Aberdeen Group, 2015.

As organizations embark on new IoT initiatives and work to extract more insight from swelling data volumes, a new data management approach is called for. Traditional databases and analytics architectures will always be vital, but the IoT calls for specific capabilities to handle diverse data constantly streaming from untold numbers of sources. IoT data is complex, vast, and fast-moving. This report examines the current state of data management and details the capabilities needed to manage IoT data and maximize value.

[Promoting investment and innovation in the Internet of Things: summary of responses and next steps.](#)

Ofcom, UK, 2015.

Ofcom has identified several priority areas to help support the growth of the IoT. Following feedback from stakeholders in 2014, these areas include spectrum availability, data privacy, network security and resilience, and network addresses.

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Strategies

[Unlocking the potential of the Internet of Things](#)

McKinsey Global Institute, 2015.

A new McKinsey Global Institute report, *The Internet of Things: Mapping the value beyond the hype*, attempts to determine exactly how IoT technology can create real economic value. Even at this early stage, the IoT is starting to have a real impact by changing how goods are made and distributed, how products are serviced and refined, and how doctors and patients manage health and wellness. But capturing the full potential of IoT applications will require innovation in technologies and business models, as well as investment in new capabilities and talent. With policy actions to encourage interoperability, ensure security, and protect privacy and property rights, the Internet of Things can begin to reach its full potential—especially if leaders truly embrace data-driven decision making.

[The Internet of Things: making the most of the second digital revolution: a report by the UK Government Chief Scientific Adviser](#)

Government Office for Science (UK), 2014.

There are more connected objects than people on the planet. The networks and data that flow from them will support an extraordinary range of applications and economic opportunities. It is crucial that the scientists, programmers and entrepreneurs who are leading the research, development and creation of the new businesses implement the technology responsibly. This review has three main objectives. The first is to explain what government can do to help achieve the potential economic value of the Internet of Things. The second is to set out what Internet of Things applications can do to improve the business of government – maintaining infrastructure, delivering public services and protecting citizens. The third is to distil this evidence into a set of recommendations.

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Regulation

[GSR discussion paper: regulation and the Internet of Things](#)

Brown, I, International Telecommunication Union / GSR (Global Symposium for Regulators), June 2015.

The purpose of this paper is to raise awareness among the ICT regulatory community of the changes led by the advent of IoT, examining the challenges and opportunities to understand how this is impacting consumers, businesses, governments and society at large. There are particular regulatory implications for licensing and spectrum management, switching and roaming, addressing and numbering, competition, security and privacy – some familiar to telecoms regulators, and other areas where different regulators typically take a lead.

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Risks

[Internet of Things poses opportunities for cyber crime.](#)

Federal Bureau of Investigation (USA), Public Service Announcement, Sept. 10, 2015. As more businesses and homeowners use web-connected devices to enhance company efficiency or lifestyle conveniences, their connection to the Internet also increases the target space for malicious cyber actors. Similar to other computing devices, like computers or Smartphones, IoT devices also pose security risks to consumers. The FBI is warning companies and the general public to be aware of IoT vulnerabilities cybercriminals could exploit, and offers some tips on mitigating those cyber threats.

[The Alliance for the Internet of Things Innovation \(AIOTI\)](#)

European Commission

The AIOTI will assist the European Commission in the preparation of future IoT research as well as innovation and standardisation policies. The members of AIOTI will jointly work on the creation of a dynamic European IoT ecosystem. This ecosystem is going to build on the work of the IoT Research Cluster (IERC) and spill over innovation across industries and business sectors of IoT transforming ideas to solutions.

[Safeguarding the Internet of Things: being secure, vigilant, and resilient in the connected age](#)

Saif, I, Peasley, S & Perinkolam, A, Deloitte University Press, 2015.

The rise of the IoT creates a new need to *protect* this information-based value. By focusing on some of the defining features of many IoT deployments, we can begin to see how the reinforcing principles of security, vigilance, and resilience can help companies protect the value they create.

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Applications

[How smart, connected products are transforming companies](#)

Porter, M and Heppelman, J, *Harvard Business Review*, November 2014.

Smart, connected products offer exponentially expanding opportunities for new functionality, far greater reliability, much higher product utilization, and capabilities that cut across and transcend traditional product boundaries. The changing nature of products is also disrupting value chains, forcing companies to rethink and retool nearly everything they do internally.

[How the Internet of Things changes business models](#)

Hui, G, *Harvard Business Review*, 29 July 2014.

As the Internet of Things (IoT) spreads, the implications for business model innovation are huge. Filling out well-known frameworks and streamlining established business models won't be enough. To take advantage of new, cloud-based opportunities, today's companies will need to fundamentally rethink their orthodoxies about value creation and value capture.

[Anticipate, sense, and respond: connected government and the Internet of Things: the Internet of Things in government.](#)

Meyers, M, Niech, C & Eggers, WD, Deloitte University Press, 2015.

To fully reap the IoT's potential benefits, public sector organizations will need to rethink how they do business—identifying new models for service and adopting the technology and the corresponding organizational structure(s) to support them. This report explores the implications for a few classic public-sector domains and posits three ways in which these new tools might redefine work.

[State of the market: the Internet of Things 2015: discover how IoT is transforming business results](#)

Verizon, 2015.

As well as demystifying IoT, we look at the factors driving adoption, offer recommendations on how to plan for growth, and make some predictions for how we think it will affect different sectors in the next 10 years. And we explain why we think that when it comes to IoT you should start small, but think big.

[How the Internet of Things changes everything: the next stage of the digital revolution](#)

Carruthers, K, *Australian Journal of Telecommunications and the Digital Economy*, Vol. 2, No. 4, Dec 2014: [69.1]-[69.13].

This article explores the context and potential offered by the growth of the Internet of Things (IoT). It provides an overview of this next phase of the digital revolution that is underpinned by the growth of the social web, web 2.0, and the convergence of technologies such as mobile and ubiquitous broadband. This article also attempts to provide some insight into the potential value of the Internet of Things market in the future.

[Cut costs and engage citizens? Try the Internet of Things.](#)

Anurag, G, *Government News*, Vol. 35, No. 3, Jun 2015: 14-15.

The public sector is in the midst of challenging times, both on the supply and the demand side of the equation. Gartner research vice president Dr Anurag Gupta explains how the Internet of Things can help the public sector to reduce costs, improve delivery of services and engage citizens.

[The economy of things: extracting new value from the Internet of Things](#)

IBM Institute of Business Value, 2015.

The Internet of Things (IoT) is now poised to bring the same real-time information and liquid marketplaces by enabling searching, managing and monetizing assets in the physical world. That won't just mean smart homes that light up when you arrive or washing machines that text you when the cycle is done. The IoT will turn physical assets into participants in real-time global digital markets. Assets around us will become as easily indexed, searched and traded as any online commodity. The Internet of Things will become the Economy of Things.

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Smart Cities

[The Things Network wants to make every city smart – starting with Amsterdam](#)

Bryant, M, *TNW News*, August 2015.

Amsterdam is set to become a 'connected city,' with the launch of a new Internet-of-Things wireless network that will allow objects to transmit data between each other – and The Next Web is helping to bring it to life. [The Things Network](#) is a first-of-its-kind system that uses low-power, low-bandwidth LoRaWAN technology to cover the city with a wireless signal that allows objects like boats, trash cans and street lights to become tools for developers.

[Internet of Things and smart cities: what happens when the 'unconnected' connect](#)

Kar, S, *SiliconAngle*, 21 January 2015.

IoT and big data are both technology-driven developments. The IoT and Smart City scenario will bring enormous market opportunities as well as make citizen lives smarter.

[Three steps towards a hierarchy of needs for smart cities](#)

Scroton, A, *Computer Weekly*, February 2016.

Smart cities face challenges around network connectivity, standardisation and data governance, say IoT experts, and these needs must be met for them to flourish.

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Transport

[The transport data revolution: investigation into the data required to support and drive intelligent mobility](#)

Taylor, N et al., *Transport Systems Catapult (UK)*, 2015.

Defined as the smarter, greener and more efficient movement of people and goods around the world, Intelligent Mobility is a sector of the wider transport industry which is predicted to be worth around £900 billion a year by 2025. In order to play a leading role in this sector, however, the UK will have to address a number of issues in regards to data access, data handling and data skills - with data having been identified as "a new form of oil" for future transport systems.

[The smart/connected city and its implications for connected transportation](#)

Cuddy, M et al., *Volpe National Transportation Systems Center, US Department of Transportation*, 2014.

The paper describes a framework for understanding the dynamics that animate smart/connected cities: intelligent infrastructure, new knowledge-generating processes, and a smart grid to power it all. In the process, it contextualizes and connects emerging and established concepts that describe technology-enabled changes such as "the sharing economy" and "crowdsourcing." Drawing on that framework, the paper argues that two trends are likely to predominantly shape the opportunities for connected transportation in future cities: 1) the rise of the Internet of Things and the essential role that vehicles play as nodes in that network; and 2) a transition away from achieving mobility through asset (car) ownership and toward accessing mobility as a service.

[Can the Internet of Things save us from traffic jams?](#)

Kobie, N, *The Guardian*, April 2015.

Computers aren't driving our cars yet and won't be for some time, but there are some connected car projects that already claim to be easing the flow of traffic. The traffic light revolution is already underway. It is all part of the promise of connected and self-driving cars, which allow data about individual journeys, routes and vehicles to be centrally monitored, controlled and systematised.

[Shipping smarter: IoT opportunities in transport and logistics: the Internet of Things in shipping.](#)

Lacey, M, Lisachuk, H, Giannopoulos, A & Ogura, A, Deloitte University Press, 2015.

Companies in this sector have embraced the suite of data-driven technologies dubbed the Internet of Things (IoT) in diverse settings, from maritime and aviation freight to warehousing to package delivery. Specific applications include the real-time tracking of shipments, warehouse-capacity optimization, predictive asset maintenance, route optimization, improved last-mile delivery, and more. As IoT applications and capabilities expand, so do opportunities for T&L providers. They will be able to more intelligently exploit their rich and complex data asset base, leading to more efficient use of transport infrastructure, better engagement with customers, and more informed decision making.

[Who owns the road? The IoT-connected car of today—and tomorrow: the Internet of Things in automotive](#)

Ninan, S, Gangula, B, von Alten, M & Sniderman, B, Deloitte University Press, 2015.

The connected vehicle has been the most visible and familiar example of Internet of Things technology. But as cars become increasingly software-driven, the real IoT developments in the auto industry are behind the scenes, as automakers and software providers both lay claim to the driver's seat.

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