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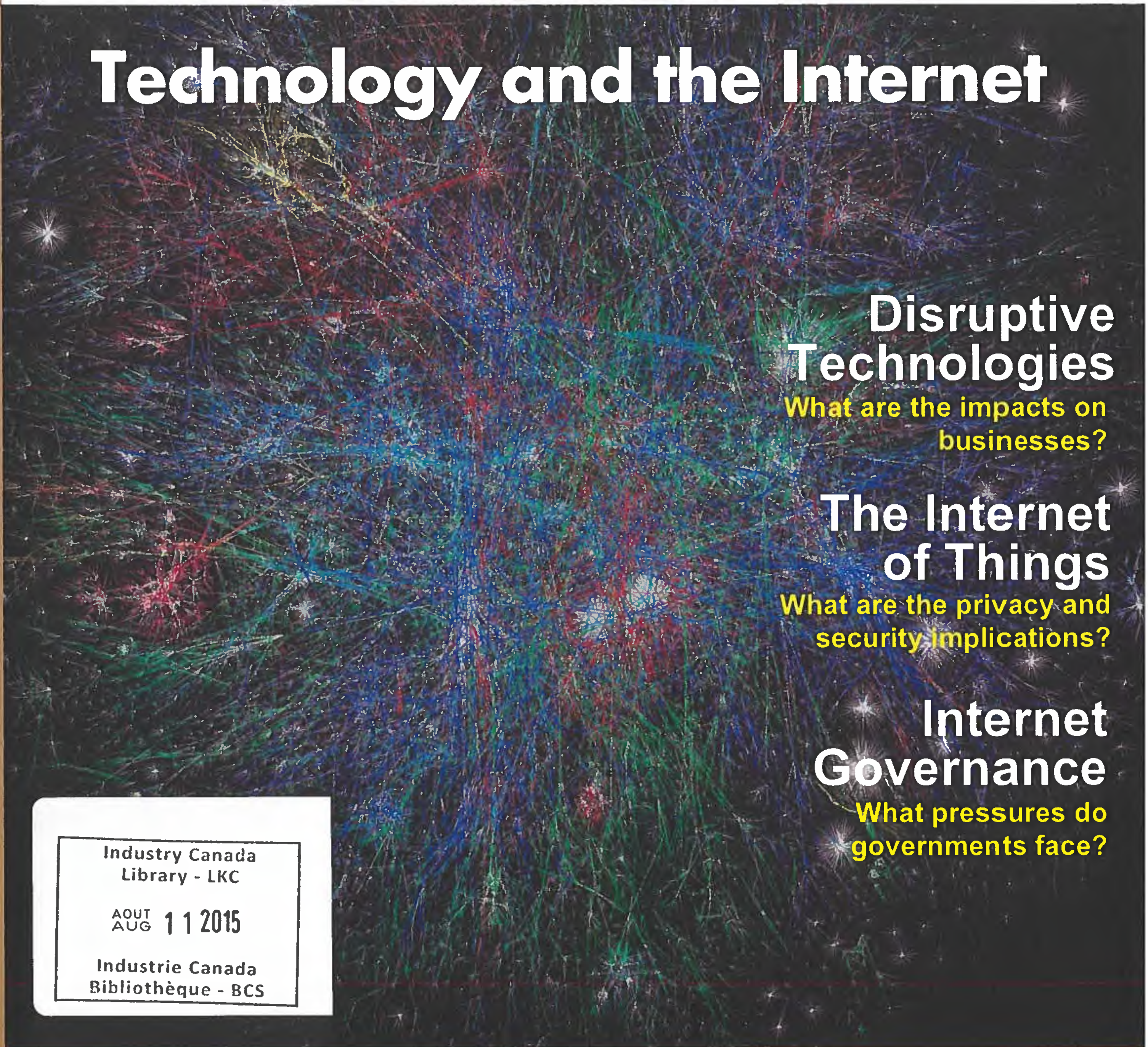
IC INSIGHTS

Technology and the Internet



Disruptive Technologies
What are the impacts on businesses?

The Internet of Things
What are the privacy and security implications?

Internet Governance
What pressures do governments face?

Canada

Recent Developments of Interest to IC

The OECD released its Economic Outlook 2015 Volume 1.

- The Organization for Economic Co-operation and Development (OECD) released its Economic Outlook, Volume 2015 Issue 1, revising down world-wide growth prospects from 3.7% to 3.1% in 2015 and 3.9% to 3.8% in 2016.
- They highlighted that while global growth is projected to strengthen as lower oil prices aid a gradual recovery, it will likely remain below long-run averages. They also emphasized the weakness in investment and risks to specific regions – tight lending conditions in parts of Europe, lower oil prices in North America, past investment excesses in China and continued adjustment in housing in much of the OECD.
- For Canada, the OECD revised down the growth outlook to 1.5% in 2015 (from 2.4%), before it is expected to recover to 2.3% in 2016 (upwardly revised from 2.1%). Upside risks for Canada include a stronger than expected rebound in oil demand and prices, while downside risks remain a disorderly housing market correction, particularly given high household debt.

Canada placed 38th out of 134 countries in the 2013 release of the Atlas of Economic Complexity.

- Economic complexity is the measure of the knowledge in a society that gets translated into the products it makes and then exports. The most complex products are sophisticated chemicals and machinery, while the least complex products are raw materials. A country is "complex" if it exports not only highly complex products, but also a large number of different products.
- The Economic Complexity Index (ECI) ranks how complex and diversified a country's export basket is. A country's ECI is based on two main factors: product diversity and product ubiquity.
- Canada fell two spots from its 2012 ranking, while Japan, Switzerland, and Germany retained their top three positions (see the Hot Chart). The US also fell two spots from last year's rankings, placing 13th in 2013.

Canada ranked 5th among 158 countries in the Sustainable Development Solutions Network's 2015 World Happiness Report.

- This was one position up from last year's report. Switzerland was the top country, followed by Iceland, Denmark, and Norway. The US ranked 15th.
- The final rankings are based on income, life expectancy, social support, generosity, perceptions of corruption, and personal freedom.
- Notably, Canada tops the ranking for volunteerism with the "highest shares of population volunteering in registered organizations" at 38.1%.
- The report also analyzed how happiness may have been affected by the recession. Comparing data between 2005-07 and 2012-14, Canada showed no significant change. Meanwhile, strong social connections were deemed critical factors for those nations that maintained their high happiness scores.

Foreword

This special edition of IC Insights is dedicated to technology and the Internet. It brings together research and analysis being done on these topics from across the department.

The first article, authored by analysts from the Industry Sector, looks at disruptive technologies. Disruptive technologies (e.g., additive manufacturing; synthetic biology; nutraceuticals) are the products of rapid breakthroughs, have broad applications, and result in significant and unexpected economic and societal change. The article discusses their impact on firms, and the role of information and communications technologies in the development of disruptive technologies. The article also looks into Canada's current strengths in such disruptive technologies.

The second article, authored by colleagues in the Spectrum, Information Technologies and Telecommunications Sector, provides a more in-depth look at a promising disruptive technology – the Internet of Things. The Internet of Things refers to the interconnection, via the Internet, of computing devices embedded in everyday objects, enabling them to send and receive data. The article looks at the disruption potential of the Internet of Things, with a focus on the rise of privacy and security concerns related to the Internet of Things.

The final article takes a broad look at an enabler of such disruptive technologies: the emergence and governance of the Internet. The article, prepared by analysts in the Strategic Policy Sector, explains the governance of the Internet and pressures on the current system, as well as providing a look ahead to decisions that will soon be made. Internet governance is currently an important issue for both Industry Canada and Canada as a whole. The existing global governance model for the Internet, based on open governance, has helped to enable the Internet to continue to evolve rapidly and has generated profound economic opportunity across the world.

Happy reading! We hope you enjoy this edition and it helps you to gain a bit more insight into related work occurring across the department.

-The IC Insights editorial team

Disruptive Technologies

Highlights

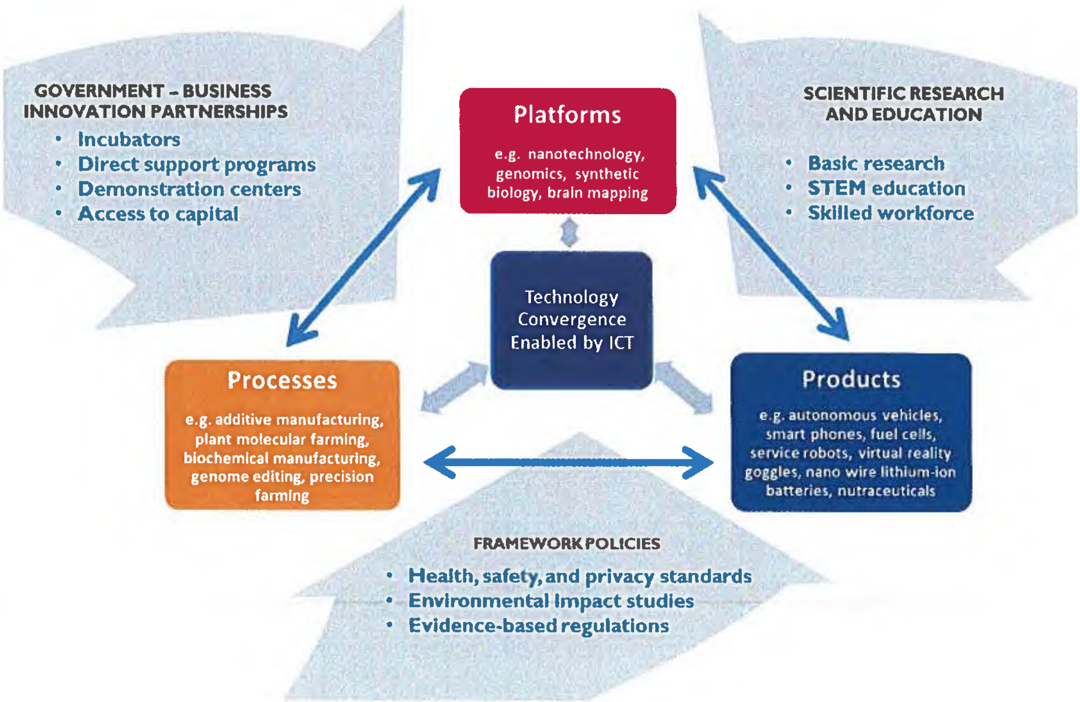
- Disruptive technologies are products of rapid breakthroughs, have broad applications, and result in significant and unexpected economic and societal change.
- Information and communications technology is at the root of today's disruptive technology.
- Canada's strengths lie in disruptive technology platforms. However, Canada is competing with the rest of the world, and we must ensure that we have both R&D capabilities and successful applications of these technologies to processes and products.

What are distruptive technologies?

"Disruptive technologies", "emerging technologies", "advanced technologies" — these terms are used frequently and, at their essence, refer to the same kinds of innovations. They are the products of rapid breakthroughs, have broad global applications, and result in significant and unexpected economic and societal change. These technologies can be platforms, processes or products (Figure 1). With today's increasingly interconnected and fast-paced markets, organizations ignore these technological developments at their own risk.

Falling prices and increased performance of technologies is driving change at an accelerated rate. Manufacturers and key players in supply chains must keep up with ever-changing needs of the consumer amidst the constant evolution of technology and market pressures.

Figure 1: Platform, Product, and Process Technologies



What is their impact on businesses?

The economic impact of disruptive technologies is expected to be significant in scale and may be both positive and negative. No economies will be untouched. Entirely new industries will be created while incumbent industries risk being disrupted if they do not react.

The demise of the film photography industry is an iconic example of market disruption. Kodak, founded in 1889, was the leading name in film and photography for most of the 20th century. In 1975, Kodak engineer Steve Sasson invented the first digital camera. Despite this, it was others who succeeded in making the digital camera ubiquitous, rendering the film photography business nearly obsolete and taking down much of Kodak with it. See Box 1 for another new technology with the potential to be disruptive.

ICT: at the root of disruptive technologies

Information and communications technology (ICT) is at the root of many of today's developments in disruptive technology. The power and speed of today's computers, combined with the connectivity of devices through the Internet, is creating new platforms, processes and products.

Consider the role of ICT in the relatively young, interdisciplinary field of bioinformatics, which develops methods and software tools for understanding biological data. Bioinformatics combines computer science, statistics, mathematics and engineering. It addresses the needs of genomics researchers who require software systems and high throughput computers to categorize and understand the huge amounts of data coming from the study of genomes of living organisms.

Thanks to ICT, bioinformatics has pushed the field of genomics by leaps and bounds. Canada has a full range of college and university programs supporting this field, including programs at Seneca College, University of Ottawa, University of British Columbia, and Dalhousie, to name a few.

ICT advances have led to the spread of genomics as a platform for life sciences and biotechnology, and genomics is leading advances in fields such as human health life sciences and agriculture.

Box 1: Autonomous Vehicles

The driverless car is an example of a disruptive technology product based on multiple advanced technologies. Sensor technologies, combined with optical cameras and advances in computing hardware and software, can be built into a vehicle to provide a fully autonomous/driverless system. Many of the major automotive manufacturers have developed prototypes of autonomous vehicles. Non-traditional auto makers, such as Google, are also entering the race to develop such driverless cars.

Autonomous vehicles are a part of a broader suite of applications for autonomous systems which include unmanned aerial vehicles (drones), unmanned marine vehicles, and robots. There are many factors that will determine the success of a new product that represents a major technological advance. The need for regulatory responsiveness is very clear, and long before driverless cars hit the roads in significant quantities, social acceptance will be critical.

Disruption on the factory floor

The combination of microchips and wireless connectivity in new process and products solutions has created what is being called the "Internet of Things", a network of objects that can transfer data without human interaction. These interactions are even happening on the manufacturing floor. Professor Michael Porter of Harvard University calls this grouping of connected technologies "smart, connected products", and highlights their importance for the competitiveness of diverse and complementary industries in the near future. Companies must capitalize on these connections to find areas to slim down, cut back and speed up. Connectivity allows for product monitoring, optimization, coordination with other systems, personalization, and self-service[1].

Businesses can use the data captured about a product's usage and performance to quickly respond to consumer needs, predicting things like repair cycles and ways to optimize and then adjust the functionality of the product. This requires hiring whole new staffing complements to design smart new products, market them, and provide after-sales services. The vast quantities of data must be managed so as to ensure the information is translated into intelligence that drives changes in manufacturing processes. It must be done in a secure manner, requiring companies to increase their expertise in data management and security.

Examples of disruptive technology platforms and processes include nanotechnology and additive manufacturing. These promise to further revolutionize manufacturing by allowing it to operate on the nano-scale, and by moving rapidly from prototyping to the manufacturing of customized designs that were previously difficult or impossible to accomplish (see Box 2 and 3).

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[1] Michael E. Porter and James E. Heppelmann. Harvard Business Review, November 2014. *How Smart, Connected Products are Transforming Competition.*

Box 2: Nanotechnology

Nanotechnology is the result of advances in understanding and manipulating novel material properties that exist at the nano-scale (that is, with at least one dimension sized from 1 to 100 nanometres, equal to one billionth of a metre). It enables development of new and improved products and production processes. Some examples:

- *Nano-engineered materials* in automotive products include high-power rechargeable battery systems and lower-rolling-resistance tires.
- *Nanostructured ceramic coatings* exhibit much greater toughness than conventional wear-resistant coatings for machine parts. Such coatings can extend the lifetime of moving parts in everything from power tools to industrial machinery.
- *Nanoscale thin films* on eyeglasses, computer and camera displays, windows, and other surfaces can make them water-repellent, anti-reflective, self-cleaning, or electrically conductive.
- *Nanoparticles* are used increasingly in catalysis to boost chemical reactions, reducing the quantity of catalytic materials necessary to produce desired results, saving money and reducing pollutants. Two important applications are in petroleum refining and in automotive catalytic converters.

Box 3: Additive Manufacturing

Industrial 3-D printing, or additive manufacturing, is the process of making three dimensional objects from a digital file by laying down successive layers of material until the entire object is created. This process is in contrast with traditional "subtractive" manufacturing (i.e., manufacturing a product by removing excess material until the product desired is all that remains, such as by milling and turning).

Given the need for customized machinery and equipment, traditional subtractive manufacturing processes require far more lead time than additive manufacturing. It also generates industrial by-products and waste, and requires substantial expenditures up-front to design and test the platform. Additive manufacturing turns this process on its head. With the aid of CAD (computer-assisted design), products can be designed on a computer and manufactured in a short period of time. This is not only a less expensive method of creating a product, but also allows for enormous flexibility to customize, produce, and work with small orders. Additive manufacturing can now be used to create products from plastic, metal, wood, resins, and even food and living tissue (called "bioprinting").

What does it mean for IC and for Canada?

Industry Canada has worked on the impact of emerging and disruptive technologies manufacturing in many areas of activity. In British Columbia, for example, Industry Canada has long been instrumental in nurturing the hydrogen fuel cell cluster in the Vancouver Area. In nanotechnology, we actively engage in international discussions and studies and recently co-organized and co-sponsored a national nanotechnology conference. In industrial biotechnology, we are engaging with federal colleagues to bring a market focus to interdepartmental priority setting.

Canada's strengths are found especially in the generation of disruptive technology platforms, such as nanotechnology, quantum computing, and advanced genomics (see Figure 2 for an overview of Canada's industrial strengths). Platforms are the foundation for the development of follow-on processes and products. The creation and maintenance of centres of research and development and hubs of knowledge has been critical. The National Institute for Nanotechnology, the Waterloo Institute for Nanotechnology, the Ontario Brain Institute, Brain Canada, the Institute for Quantum Computing, the Perimeter Institute, and Genome Canada are just a few examples of research assets in Canada that position Canada as a leader in these fields.

Role of government

Canada has a dynamic technology culture, with many growth-oriented firms with promising technologies and products. The key is to see more of these firms seize opportunities in global value chains or lead in their respective sectors. Programs like the Advanced Manufacturing Fund (AMF), for example, aim to do just this. The AMF, delivered by the Federal Economic Development Agency for Southern Ontario, in

Figure 2: Canada's sectoral and technology strengths are wide-ranging. This map illustrates some of the many manufacturing and R&D related centres that can be found across the country. The evolution of technology is creating high-value opportunities in all sectors – including those that were once considered low-tech, resource-based, or labour-intensive. Performance apparel, technical textiles, and wearable electronics are examples of these changes.

collaboration with Industry Canada, supports the development of cutting-edge technologies and large scale transformative activities that will improve processes, increase productivity and benefit clusters or global supply chains. This program is in addition to a whole suite of programs that support innovation, such as: the Technology Demonstration Program; and, the Automotive Supplier Innovation Program; the National Research Council's Industrial Research Assistance Programs; and the Networks of Centres of Excellence programs, including the Centres of Excellence for Commercialization and Research and the Business-Led Networks of Centres of Excellence.

Conclusion

Developing and commercializing disruptive technologies requires technical and engineering investments, skilled labour, access to capital, and business acumen. In this regard, Canada is competing with the rest of the world. Being laggards in the race to bring commercial applications of disruptive technologies to the market presents a real risk for the economy, as first and early movers set the standards for the race and reap the rewards of becoming the world's technology suppliers. Strength in R&D capabilities is only part of the equation. Disruptive technologies are "disruptive" only to the extent that they can be applied successfully to processes and products, and in that way, confer competitive advantage to those developing or adopting them. Canadian companies like Kinova Robotics (Montreal), Thalmic Labs (Waterloo), Quantum Silicon (Edmonton) and D-Wave Systems (Vancouver) are poised to take on the challenge of bringing new technologies to market. We need to ensure we have the right policy framework in place so that these firms and the next wave of disruptive firms can blossom in Canada.

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The Internet of Things: Privacy and Security Implications

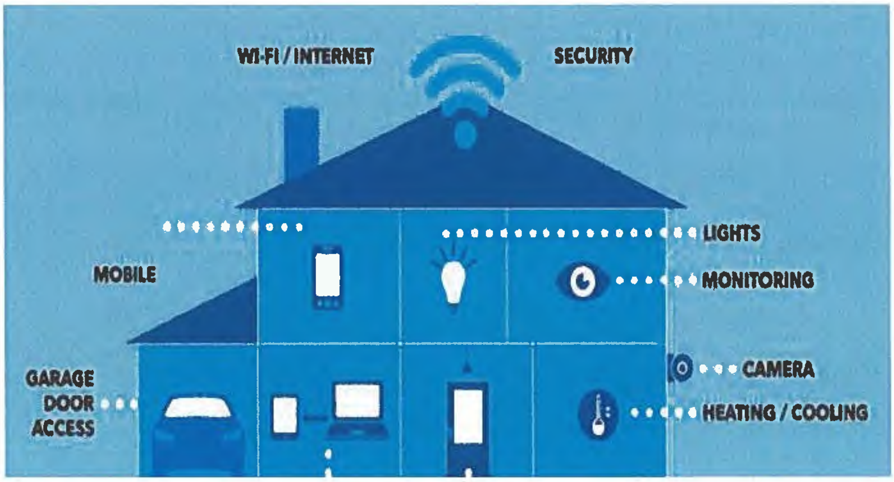
Highlights

- The Internet of Things (IoT) refers to the interconnection, via the Internet, of computing devices embedded in everyday objects, enabling them to send and receive data.[1]
- Along with the convenience of having everything connected, IoT also brings along its share of concerns related to privacy and security.
- Industry Canada is taking proactive steps to ensure that Canadians can reap the full benefits of IoT, while mitigating threats and risks.

Introduction

The IoT revolves around the ability of everyday objects and devices – from thermostats to wearable fitness trackers – to sense and collect data in real time from the physical world. This data can then be analyzed, often in the cloud, and often using big data analytics. The IoT is possible today as a result of unprecedented technology developments over the past decade. For instance, drastic improvements in wireless and network capabilities enable cheaper and faster Internet connections, along with anytime/anywhere access. The proliferation of short-range communications and sensor technologies, such as Bluetooth and Wi-Fi, which have the ability to collect, store, and transmit data, is a significant enabler of IoT. This has also challenged the way we regulate spectrum, given increasing demand.

Figure 1: The Internet of Things in the Home[2]



Short-range communications and sensor technologies have begun to make their way into the everyday world of household objects and appliances (Figure 1). According to Gartner, there will be 26 billion smart devices globally by 2020.[3] Moreover, a recent report from International Data Corporation (IDC)

[1] Oxford Dictionary, "Internet of Things": http://www.oxforddictionaries.com/definition/american_english/Internet-of-things
[2] Best Buy, "Your Home Connected: Concept Becomes a Reality at Best Buy": https://corporate.bestbuy.com/your-home-connected-concept-becomes-reality-at-best-buy/

[3] Gartner, "Gartner Says the Internet of Things Will Transform the Data Center": http://www.gartner.com/newsroom/id/2684915

indicated that the Canadian IoT market will grow from C$2.88 billion in 2013 to C$6.5 billion in 2018, more than doubling over five years.[4] The study notes that significant opportunities go well beyond household applications and include manufacturing, healthcare, transportation, and consumer goods, such as wearable technologies.

Potential issues

While the IoT has great consumer benefits and market potential, privacy and security are significant concerns. With connectivity to the Internet and the ability to record voice and image, smart devices in our private spaces pose a risk if exploited.

Privacy

A Hewlett-Packard (HP) study on the IoT[5] focusing on devices, cloud and mobile applications found that even though most data shared within a home are sensitive, the network service was often unencrypted. Passwords are among the simplest way for consumers to protect themselves, yet the study found that poor authentication and authorization practices were common. In some cases, security systems could be accessed and streamed live on the Web because default passwords were left in place.[6]

In the same manner, a study conducted by Veracode, a company specializing in cloud-based application security, a number of smart devices ranging from voice-operated computers to garage door openers were tested to determine their vulnerabilities[7]. Not surprisingly, it found these devices can provide a platform for malicious activity if not effectively protected. This includes the potential for spyware infiltration, access to sensitive data, remote control of the device, and knowing when a home owner is absent.

Recent media articles have highlighted that some Smart TVs can capture private conversations and transmit data to a third party using built-in voice recognition software.[8] Television manufacturers explained that voice data is not retained or sold to third parties without consent; however, the onus is on the consumer to deactivate the voice recognition feature or disconnect their TVs from Wi-Fi should they be concerned. The assumption is that Smart TV owners are aware and have a level of tech-savviness to be able to change the settings.[9] Devices of the not-too-distant future could enable manufacturers, vendors, or ad partners to track their consumers' habits – benefitting from knowing what people do in their everyday lives.

Security-by-Design

There is a collective call by security experts for organizations to incorporate "security-by-design" into their development processes. Security-by-design means that security is considered throughout the entire process of product development, and that certain default "settings" are in place. This practice is

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[4] IDC, "Canadian Internet of Things 2015-2018 Forecast by Industry"
[5] HP Internet of Things research study: http://www8.hp.com/h20195/V2/GetPDF.aspx/4AA5-4759ENW.pdf
[6] Network World, "Peeping into 73,000 unsecured security cameras thanks to default passwords": http://www.networkworld.com/article/2844283/microsoft-subnet/peeping-into-73-000-unsecured-security-cameras-thanks-to-default-passwords.html
[7] Help Net Security, "IoT devices facilitate robbery, stalking and cyber crime": http://www.net-security.org/secworld.php?id=18177
[8] Newsweek, "Shh! Your Smart TV is listening!": http://www.newsweek.com/shh-your-smart-tv-listening-305503
[9] Slate, "Stopping a Smart TV from Eavesdropping on you could be a Felony": http://www.slate.com/blogs/future_tense/2015/02/10/samsung_s_smarttv_disabling_its_eavesdropping_could_violate_dmca.html

critical if security is to be inherently part of the product. However, this practice is generally not adopted by manufacturers who are eager to commercialize their products quickly and to minimize costs. In addition, security experts do not believe that there is a business case to add costly security features into some of the more "disposable" and inexpensive products (e.g., connected lightbulbs).

A lack of security-by-design results in default settings that consumers do not change, or are unaware they should change, among other security gaps.[10] The solution tends to be patches and other aftermarket updates to fix security issues. However, experts point out that patches are not likely to be a quick enough solution in those instances when a cyber-security risk can become a physical risk.[11]

Standardization

Standards are often discussed as a means of providing a baseline for cyber security. According to Symantec, a technology company that makes security, storage, backup and availability software, there is currently no standard protocol for the IoT.[12] The challenge is the cost effectiveness of applying an industry standard, especially for small and medium-sized enterprises (SMEs). While standards support safety, there are financial ramifications for standardization that would impact both manufacturers and consumers. As well, the traditional standards development process does not align well with time constraints and adaptability of modern digital technology. Given the constantly changing landscape of IoT products, maintaining an industry standard could be difficult.

Opportunities

While the IoT presents some challenges from an adoption perspective, it also provides significant market opportunities for Canadian firms. In order for Canada to take advantage of these opportunities, while minimizing the associated risks in usage, robust framework policies are required. To this end, Industry Canada is actively engaged in improving privacy and cyber security frameworks that support business, academics and consumers. The Government recently introduced measures to further strengthen Canada's digital privacy framework. Bill S-4, the Digital Privacy Act, includes provisions to require rigorous notification and reporting of data breaches, and clear consent requirements when dealing with vulnerable populations, such as children. The ultimate objective is to increase the comfort level of citizens, consumers and businesses in using digital media. As well, IC (through SITT) is actively engaged with partners across government to continuously strengthen Canada's Cybersecurity Strategy. This means contributing to a safe and secure Internet; ensuring appropriate safeguards are in place for various devices and technologies; and working to understand the needs of businesses and consumers – the ultimate users – in staying safe in their on-line activities. As well, IC is keen to ensure Canadian ICT firms engaged in cybersecurity work are able to showcase their products to the world, and to support world-class 'game changers', such as the Institute for Quantum Computing (IQC), which is working on quantum key encryption technologies.

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[10] Toptal, "Are we creating an insecure Internet of Things": http://www.toptal.com/it/are-we-creating-an-insecure-internet-of-things
[11] CIO, "Internet of Things Demands Security by Design": http://www.cio.com/article/2866679/security-and-privacy/internet-of-things-demands-security-by-design.html
[12] Symantec, "Insecurity in the Internet of Things": http://www.symantec.com/content/en/us/enterprise/media/security_response/whitepapers/insecurity-in-the-internet-of-things.pdf

Policy implications and challenges

The implications for IC are significant. Spectrum use and regulation is central to supporting the proliferation of IoT connectivity. Supportive policies and programs that encourage the creation, commercialization, and adoption of IoT technologies in Canada is critical for growth of our ICT sector, and our economy overall. Robust consumer information in support of digitally literate citizens is critically important for appropriate adoption and use. To this end, privacy and security are key.

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Internet Governance

Highlights

- The importance of the Internet today is reflected in almost every commercial interaction in the global economy.
- The existing global governance model for the Internet, based on private sector leadership and a decentralized decision-making ecosystem, is what has enabled the Internet to continue evolving rapidly and to generate profound economic opportunity.
- But this model is increasingly coming under pressure as some governments seek a greater decision-making role.

Introduction

The Internet is a complex and highly distributed system of tens of thousands of interconnected networks that function as a single global network, linking together billions of users and devices. It is at the nexus of new economic growth and broader global power struggles.

This article provides an overview of the technical underpinnings that makes the Internet work and how it is governed. Though this aspect is not well understood, it has profound economic, social, and political implications.

Why does the Internet matter?

The Internet has become a vibrant foundation for economic activity in the 21st century. The original Internet that took off in the 1990s was a game changer for many. Day-to-day activities of acquiring information and completing transactions, or interacting and collaborating, were costly and time consuming. The Internet significantly reduced these costs and increased the speed of performing these functions[1].

The importance of the Internet today is reflected in almost every commercial interaction in the global economy, from communications to logistics, management, transportation, production, and services, among many others. In recent years, the Internet has undergone an astounding expansion with the number of users growing from roughly 360 million in 2000 to 3 billion in 2015[2] and global online transactions reaching an estimated $10 trillion annually.[3] Between 2004 and 2009, the Internet accounted for 21% of Gross Domestic Product (GDP) growth on average in mature economies.[4] Across the G20 it generated

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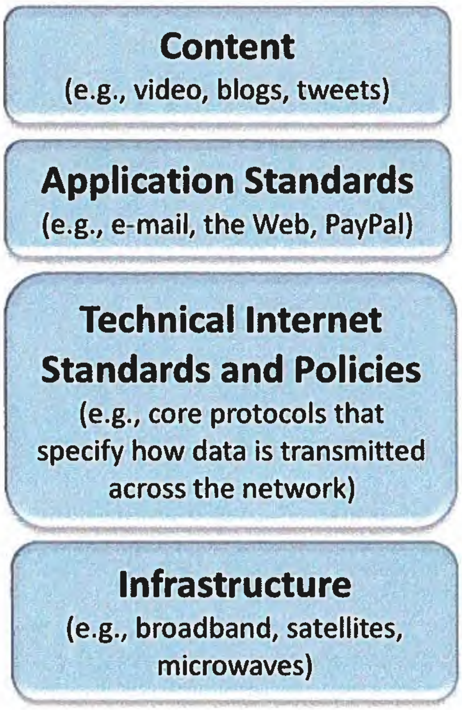
[1] Michael Spence (2011), *The Next Convergence: The Future of Economic Growth in a Multispeed World*
[2] Michael Kende (2014), *Global Internet Report*
[3] Information Technology and Innovation Foundation (2010), *The Internet Economy 25 Years After .com*
[4] McKinsey Global Institute (2011), *The Great Transformer: The Impact of the Internet on Economic Growth and Prosperity*

$2.3 trillion of observed GDP in 2010, and this contribution is expected to double to more than $4 trillion by 2016.[5]

The magnitude of economic opportunities derived from the expansion of Internet applications and services is still nascent. There is profound potential as the technology continues to evolve and connectivity is amplified. As seen in a previous article in this edition of IC Insights, the "Internet of Things" promises a world in which everything – from individuals to inanimate objects – has a digital identity that enables computers to better organize, manage, and coordinate everyday functions. The "Industrial Internet" promises a vivid convergence of the global industrial systems with the power of advanced computer, analytics and low-cost sensors. Hundreds of machines in large scale manufacturing plants can communicate to reduce production costs, get products to market more quickly, and increase efficiencies. Overall, it is estimated that the potential economic benefit of the Internet of Things ranges from $10 to $19 trillion over the next decade.[6] The open Internet plays a central role in realizing this benefit.

How does the Internet work?

Figure 1: The Internet Stack



Think of the Internet as a stack of integrated layers (Figure 1). At the bottom of the stack is the physical infrastructure that data is transmitted across (e.g. broadband, satellites, microwaves). In the middle is the technical Internet standards and policies layer – also known as the network layer. This consists of the core "rules" that specify how data is transmitted across the network. These rules enable applications to be built on top. The application standards layer (e.g., e-mail, the Web, PayPal) is where innovation occurs. Finally, at the top of the stack are services and content that is delivered via the applications. Within the stack, the governance of the Internet occurs at the network layer.

The Internet is vibrant and continually evolving but there are fundamental properties that make it what it is[7]. One of these is "openness", which means that Internet technical standards and protocols are non-proprietary. Users can experiment at the edges of the network, spurring innovation. This has led to the creation of innovative new products, services and business models. Skype's voice over Internet protocol (VoIP) service is a great example. Another property is "interoperability", which means that the Internet functions as a single global network, despite being a complex system of distributed networks. In this particular case, "distributed" means that there are multiple paths that data can take across the network to get from one point to another. If any of these fundamental properties were to change, the Internet would cease being the technological phenomenon that the world knows today.

[5] The Boston Consulting Group (2012), *The Internet Economy in the G-20*
[6] General Electric (2012), *Industrial Internet: Pushing the Boundaries of Minds and Machines*
[7] Leslie Daigle (2015), *On the Nature of the Internet*

Who governs the Internet?

The Internet has no central decision-maker. The development of standards is led by a multi-stakeholder technical community based on merit rather than status. Policies to allocate these standards are developed via inclusive, multi-stakeholder processes. Internet users, businesses, expert technical organizations, and governments collectively make decisions based on consensus. This approach recognizes that everyone who has a stake in the governance of the Internet should have a voice, but no one should be able to unilaterally control it[8].

The multi-stakeholder model is what has helped to preserve the fundamental properties of the Internet and provided the necessary flexibility for the Internet to continue to evolve and scale to accommodate exponential user growth. But this model is increasingly coming under pressure.

Pressures

Democratic values of equality, participatory openness and multi-stakeholder oversight are assumed to be inherent to the Internet's design and cannot be suppressed[9]. However, there might still be divergent approaches to addressing content issues, such as copyright, spam, and harmful or illegal content. Such issues are generally subject to frameworks of general application, where national jurisdiction applies.

There is often a clash of values with respect to governments' approaches to content on the Internet. Some governments, for example, are concerned about their ability to influence public speech and consider the Internet and its free flow of information as a threat to their stability. They are seeking a greater decision-making role over technical aspects of the Internet in order to control online content.

Pressures can also arise from governments seeking to develop legislation or to regulate at the national level. Some policy measures can threaten the Internet's openness. One example is relying on technical solutions to enforce policy measures, such as addressing copyright infringement online by requiring Internet service providers to block or take down web pages. Another example is requiring companies to keep the data of citizens on servers physically located in their country. These data storage requirements are generally directed at specific types of data and motivated by a range of concerns about privacy and security. However, due to the borderless nature of the Internet, they can have wide ranging implications on cross-border data flows and related costs.

Looking ahead

We are now at a key juncture for the future of the Internet as the U.S. Department of Commerce prepares to step back from its historic stewardship role for one of the key Internet technical organizations—the Internet Corporation for Assigned Names and Numbers (ICANN). At the request of the U.S., ICANN has convened a global process to develop a proposal that transitions the U.S. role to the global multi-stakeholder community. A notional timeline is in place for the end of 2015.

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[8] Carl Bildt (2014), Remarks at NETmundial.
[9] Laura DeNardis (2014), *The Global War for Internet Governance*.

The transition presents an important opportunity to strengthen the multi-stakeholder model by making existing institutions more transparent, accountable and inclusive. Governments will have a determinative role in either enhancing or undermining the outcome of this process.

Conclusion

Industry Canada will continue to advocate the need for an open Internet that will continue to spur global economic growth. This will require engagement with Canadians and like-minded partners at the national and international level to influence the debate on Internet governance taking place among governments over the next year.

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IC Insights Data Table

Monthly Economic Indicators

	Reference period	Month-over-month growth (at monthly rates): Latest month	Prev. month	2 Months before	Q-o-q growth: 2015Q1	Year-over-year growth: 2014	2013
Mfg sales (current $)	Mar '15	2.9	-2.2	-3.1	-2.9	5.2	0.3
Mfg sales (constant $)	Mar '15	2.9	-3.0	-2.4	-2.1	2.6	-0.9
Retail trade (current $)	Mar '15	0.7	1.5	-1.4	0.1	4.6	3.2
Retail trade (chained $)	Mar '15	0.1	1.0	-0.6	-0.4	3.5	2.9
Real GDP	Mar '15	-0.2	-0.1	-0.2	-0.2	2.4	2.1
-Services	Mar '15	0.2	0.1	-0.2	0.2	2.3	2.0
-Manufacturing	Mar '15	0.1	-1.1	-0.9	-0.8	3.0	-0.3
Exports (bop) (current $)	April '15	-0.7	-0.5	-1.6	-3.3	10.4	3.5
Imports (bop) (current $)	April '15	-2.5	3.6	-1.1	1.0	7.7	2.6
All-items CPI	April '15	-0.1	0.3	0.2	-0.1	1.9	1.0
Core CPI	April '15	0.0	0.4	0.1	0.5	1.8	1.2
LFS employment (Δ in 000s)	May '15	58.9	-19.7	28.7	63.1	121.3	125.7
Unemployment rate (%)	May '15	6.8	6.8	6.8	6.7	6.9	7.1
US employment (Δ in 000s) (CPS)	May '15	272.0	192.0	34.0	889.0	2,771.0	1,391.0
US unemployment rate (%)	May '15	5.5	5.4	5.5	5.6	6.2	7.4

Financial Indicators

	Reference period	Current value	Monthly average: Latest full month	Prev. month	2 Months before	Annual average: 2014	2013
Bank rate (%)	Jun 4 '15	1.00	1.00	1.00	1.00	1.25	1.25
Exchange rate	Jun 4 '15	124.8	121.8	123.3	126.2	110.5	103.0

Quarterly Economic Indicators

	Reference period	Quarter-over-quarter growth (at annual rates): Latest quarter	Prev. quarter	2 Quarters before	Year-over-year growth: 2014	2013
Real GDP	2015Q1	-0.6	2.2	3.2	2.4	2.0
Final consumption expenditure	2015Q1	0.1	1.8	1.7	2.0	1.9
Gross fixed capital formation	2015Q1	-7.0	1.0	5.7	0.2	0.4
-Machinery & equipment	2015Q1	-7.4	-2.5	10.2	1.0	-1.7
Exports	2015Q1	-1.1	-1.7	8.4	5.4	2.0
Imports	2015Q1	-1.5	1.6	4.2	1.8	1.3
Final domestic demand	2015Q1	-1.6	1.6	2.6	1.6	1.5
Labour productivity	2015Q1	-0.5	1.4	1.3	2.7	1.1
Unit labour cost	2015Q1	5.0	-0.3	0.8	1.0	1.3
Industrial capacity utilization (%)	2014Q4	83.6	83.2	82.6	82.8	81.2
Real US GDP	2015Q1	-0.7	2.2	5.0	2.4	2.2

Abbreviation Guide

GDP	*Gross Domestic Product*
BOP	*Balance of Payments*
CPI	*Consumer Price Index*
LFS	*Labour Force Survey*
CPS	*Current Population Survey*
000s	*Thousands*
Q-o-q	*Quarter-over-quarter*
IMF	*International Monetary Fund*
OECD	*Organisation for Economic Co-operation and Development*
WTO	*World Trade Organisation*

Sources for the IC Insights Databoard

Statistics Canada	www.statcan.gc.ca
Bank of Canada	www.bankofcanada.ca
US Bureau of Economic Analysis	www.bea.gov
US Bureau of Labour Statistics	www.bls.gov

IC Insights Hot Chart

Economic Complexity Index Value, 2013