

2.1 Introduction

The Internet has changed the world. Open access to the Internet has revolutionized the way individuals communicate and collaborate, entrepreneurs and corporations conduct business, and governments and citizens interact. At the same time, the Internet established a revolutionary open model for its own development and governance, encompassing all stakeholders.

In this context, openness should be understood as including:

- decision-making with a sense of equity and fairness among participants, based on broad consensus, transparency, and thoughtful consideration of diverse interests and viewpoints, and,
- the ability for any interested and informed party to participate and contribute in the development of standards or decisions.

The development of the Internet relied critically on establishing an open process. Fundamentally, the Internet is a ‘network of networks’ whose protocols are designed to allow networks to interoperate. In the beginning, these networks represented different communities – including academia, research, and defence – whose members needed to cooperate to develop common standards and manage joint resources.

As the Internet was commercialized, vendors and operators joined the open protocol development process and helped unleash an unprecedented era of growth and innovation.¹ Vendors found value in adopting standards that promoted interoperability between products across the industry, including their competitors, which in turn ensured that operators’ networks could interconnect globally.



“A working definition of Internet governance is the development and application by governments, the private sector and civil society, in their respective roles, of shared principles, norms, rules, decision-making procedures, and programmes that shape the evolution and use of the Internet.”

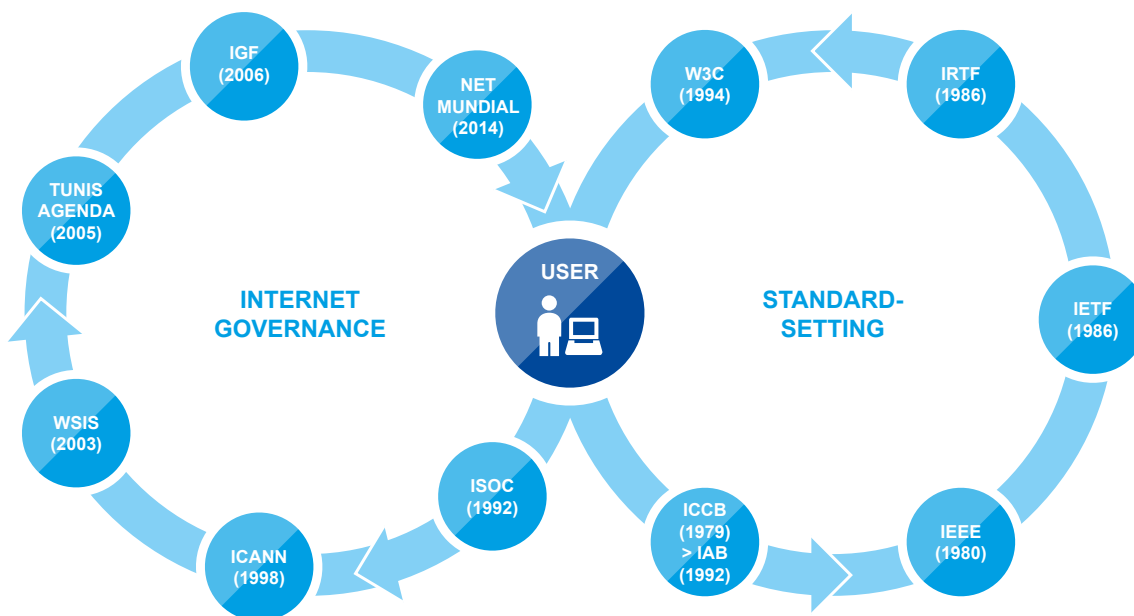
Tunis Agenda for the Information Society, 18 November 2005, Paragraph 34

The collaboration between the communities of interest was made possible by the tools they themselves created to communicate and share information across this global inter-network, such as email, file transfers, and then the World Wide Web. Indeed, the users, innovators, and stewards of the network were one and the same, creating a vital feedback loop among all parts and interests in the system. This loop has ensured that the openness of the process developing the network is reflected in the open usage of the network, and vice versa.

The spirit of collaboration that underpinned the foundation of the Internet has now extended to a multistakeholder governance model for determining policy over shared Internet resources. The result is an infinite loop, as shown in Figure 2.1, in which users of all kinds develop the standards underpinning the Internet and in turn provide stewardship for the resulting resources and related policies. This leads to a common, interoperable, and accessible environment that fosters seamless connectivity, consumer choice, and fundamental rights of expression, and it enables end users to advance their social and economic objectives.

Figure 2.1: Infinite feedback loop of Internet development and governance

[Source: Internet Society, 2014]



Standards: The Internet Configuration Control Board (ICCB) became the Internet Advisory Board in 1984, then the Internet Activities Board in 1986, and finally the Internet Architecture Board (IAB) in 1992, operating under the auspices of the Internet Society. IEEE traces its roots back to 1884, but its first involvement in networking standards that are today used to access the Internet dates to 1980, with the first 802 working group, whose standards include IEEE 802.3, better known as Ethernet, and IEEE 802.11, better known as WiFi. For a history of the latter, see http://www.ieee.org/wiki/index.php/Wireless_LAN_802.11_Wi-Fi. The Internet Engineering Task Force (IETF) and Internet Research Task Force (IRTF) are overseen by the IAB, and all work on Internet standards. The World Wide Web Consortium (W3C) works on Web standards. For more details, see the Brief History of the Internet, at <http://www.internetsociety.org/internet/what-internet/history-internet/brief-history-internet>.

Internet governance. For more on the Internet Society (ISOC) see www.internetsociety.org; for more information on the World Summit on the Information Society (WSIS) and the Tunis Agenda see <http://www.itu.int/wsisis/index.html>; for more information on the Internet Governance Forum (IGF) see <http://www.intgovforum.org/cms/>. For more information on NETmundial, see <http://netmundial.br>. The Internet Corporation for Assigned Names and Numbers (ICANN) manages resources for global naming and addressing capabilities. See www.icann.org.

In particular, arising from the Internet's historical roots is a system in which users actively participate in decision making over standards and governance. By ensuring that no single stakeholder 'owns' Internet development or governance, the open model ensures that the Internet continues to meet the needs of all stakeholders.

In the following sections, we provide an overview of the Internet ecosystem and the involvement of different parties in different processes. We then proceed to highlight openness as it pertains to Internet governance and standard setting, and also how the underlying multistakeholder model can be applied to selected regional development efforts.

Internet ecosystem

'Internet ecosystem' is the term used to describe the organizations, communities, and interactions that have evolved to guide the operation and development of the technologies and infrastructure that comprise the global Internet. The term implies an evolution, focusing on the rapid and continued development and adoption of Internet technologies. It is characterized by the involvement of a broad range of stakeholders; open, transparent, and collaborative processes; and the use of services and infrastructure with dispersed ownership and control.

Organizations that comprise the Internet ecosystem include:

- Technical standards bodies, such as the Internet Engineering Task Force (IETF), the World Wide Web Consortium (W3C), and the Institute of Electrical and Electronic Engineers (IEEE)
- Organizations that manage resources for global naming and addressing capabilities, such as the Internet Corporation for Assigned Names and Numbers (ICANN) (including its current operation of the Internet Assigned Numbers Authority (IANA) function), Regional Internet Registries (RIRs), and Domain Name Registries and Registrars
- Companies that provide network infrastructure services, such as domain name service providers, network operators, cloud and content delivery network providers, and Internet exchange points (IXPs)
- Individuals and organizations that use the Internet to communicate with each other and offer services and applications, or develop content, and

- Organizations that provide education and build capacity for developing and using Internet technologies, such as multilateral organizations, educational institutions, and governmental agencies.

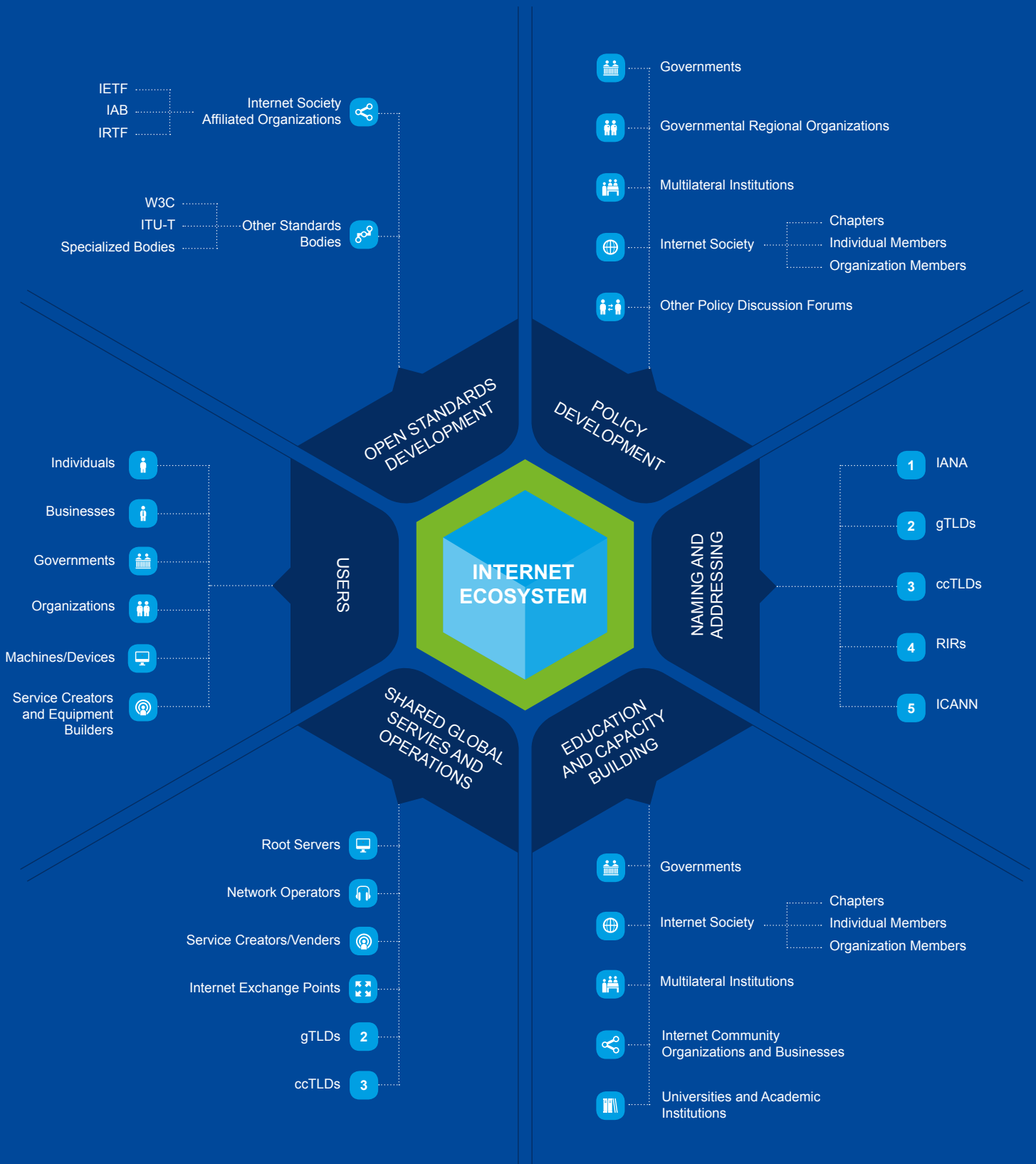
Within the Internet ecosystem, these organizations have responsibilities for the protocols and standards that enable basic end-to-end communications (such as the Internet Protocol); the resources that direct these communications (such as IP addresses and the Domain Name System (DNS)); the provision of reliable connectivity that ensures the communications reach their intended destinations (such as undersea and terrestrial cable systems, access networks, and IXPs); and the policies, frameworks, and educational activities necessary to ensure the Internet's openness, continuity, and flexibility.

As evidence of the continued evolution of the ecosystem, in March 2014 the US National Telecommunications and Information Administration (NTIA) announced its intention "to transition key Internet domain name functions to the global multistakeholder community".² IANA, which is currently administered by ICANN, manages the DNS root zone, IP addresses, and the IP technical parameter registries. NTIA has asked ICANN to convene global stakeholders to develop a proposal to transition NTIA's current role as steward of the IANA functions, thereby recognising the interest and ability of the multistakeholder community to absorb this key role.³

The technologies, resources, and services of the Internet ecosystem are all highly interdependent and require a significant amount of coordination. Each organization involved has a specific role and provides fundamental value to the overall functioning of the Internet. These organizations and roles are highlighted in Figure 2.2.

Figure 2.2: Internet ecosystem

[Source: Internet Society, 2014]



These organizations have a proven, long-standing relationship with one another and have contributed to the Internet's incredible growth and stability. They make use of well-established mechanisms, including open, public meetings, mailing lists, and bottom-up policy development processes that enable direct participation by any interested party. These attributes give the system the flexibility to respond and adapt to the Internet's rapidly evolving technology and to the changing needs of the Internet community. The result is a significant body of knowledge and experience in the successful administration and management of the technologies, resources, and services that make the Internet the success it is today.⁴

Multistakeholder model

The development, governance, and coordination of the Internet results from discussions, debates, and policy development processes in many specialized forums. Active participation by end users, governments, business, civil society, and technical experts (whether as individuals or organizational representatives) is essential to develop the policies, approve the procedures, and write the standards that make the Internet the efficient and effective system it is today.

We will now examine, in turn, how such multistakeholder participation operates, specifically with respect to Internet governance, open standard setting, and regional development efforts.

2.2 Internet governance

Introduction

Internet governance first came to the fore at the United Nations World Summit on the Information Society (WSIS) in 2003. WSIS was held in two phases: in Geneva in 2003, and in Tunis in 2005. At the first summit, governments, being confronted with difficult questions relating to Internet governance, decided to set up a working group to examine the issue and develop a definition of Internet governance. The resulting Working Group on Internet Governance (WGIG) ushered in a new form of collaboration between governments and non-state actors, and greatly influenced the second phase of the Summit in 2005, which adopted the Tunis Agenda for the Information Society.

The WGIG process illustrated the importance of non-state actors – and led to the realization by governments that permitting an inclusive transparent structure, where

2,632

*Participants from 111 countries
at the IGF in Bali, Indonesia,*

22-25 October 2013

[Source: Internet Governance Forum, 2014]

constructive contributions from new parties could be incorporated, would ultimately lead to a more informed debate and to potentially better results. WSIS by and large endorsed the Internet model of multistakeholder cooperation and accepted the working definition of Internet governance proposed by WGIG, as quoted on the first page of this section.⁵

In the text that followed, governments went on to recognize the important roles and expertise of stakeholder groups, while holding for themselves “policy authority, rights and responsibilities for international Internet-related public policy issues”. Importantly, however, they committed:

*to improve the coordination of the activities of international and intergovernmental organizations and other institutions concerned with Internet governance and the exchange of information among themselves, [stating clearly that a] multistakeholder approach should be adopted, as far as possible, at all levels.*⁶

The Tunis Agenda has become a foundational document in the discussion on Internet governance, and the WSIS process itself has come to serve as a baseline not just for Internet governance, but also for governance discussions more broadly.

Since 2005, more governmental and intergovernmental processes have begun experimenting with, and benefiting from, the principles of the open, multistakeholder model that has shaped the Internet. The result is a number of international, regional, and national organizations, meetings, and discussions allowing multistakeholder participation:

- The Internet Governance Forum (IGF), created by WSIS, pioneered an open and inclusive form of multistakeholder cooperation under the UN umbrella. The IGF is now in its ninth year and has influenced other organizations and processes to open up to multistakeholder cooperation.
- The 2008 OECD Ministerial Meeting on the Internet Economy resulted in the introduction of two new advisory committees to the OECD focusing on Internet issues, one comprising global civil society, the second drawing on the organizations of the Internet technical community.
- As discussed above, NTIA has announced its intention to allow the IANA functions to evolve, based on a multistakeholder transition process, while specifying that NTIA’s role cannot be replaced by a government-led solution.

- Several regional organizations, such as the Council of Europe, the African Union (AU), the Inter-American Telecommunications Commission (CITEL), the Caribbean Telecommunication Union (CTU), and the Asia-Pacific Economic Cooperation (APEC), have welcomed the contributions of qualified organizations and stakeholders to their work.
- At the national level, the Brazilian Internet Steering Committee (CGI.br) was created by an interministerial order in 1995, and consolidated in a presidential decree in 2003, to address the full range of national-level Internet governance activities on a multistakeholder basis, with representatives of the government, corporate sector, academia, and civil society. The *Marco Civil da Internet*, the Brazilian Internet Bill of Rights, signed on 23 April 2014, aims to safeguard the rights of Internet users and ensure that the multistakeholder approach continues to guide the development and use of the Internet.
- In April 2014, Brazil hosted the Global Multistakeholder Meeting on the Future of Internet Governance, or NETmundial, a multistakeholder set of discussions on Internet Governance principles and a roadmap for future evolution of the Internet Governance Ecosystem. The preparations and resulting document showed multistakeholder consensus building in action, along with a template for further steps.

The debates that will take place in the next few years on a variety of topics, including the evolution of the IANA functions, are critical to the continuing evolution of the open, multistakeholder model of Internet governance and to the sustainability of the open Internet itself.

It is important for organizations and individuals who care about the future of the Internet to act on the opportunities to contribute and participate in these meetings, and thereby to demonstrate the effectiveness of the model. Open and inclusive processes are based on bringing civil society, business, the Internet technical community, and governments together to shape a common approach that meets the challenges of an increasingly complex world.

As indicated in the results of the GIUS survey, in spite of the coverage of a number of important governance issues in recent years, when asked who is responsible for managing the global Internet, only 15% of respondents correctly indicated that the responsibility is shared among “[a]

30 Sept. 2015

Expiration of current IANA functions contract

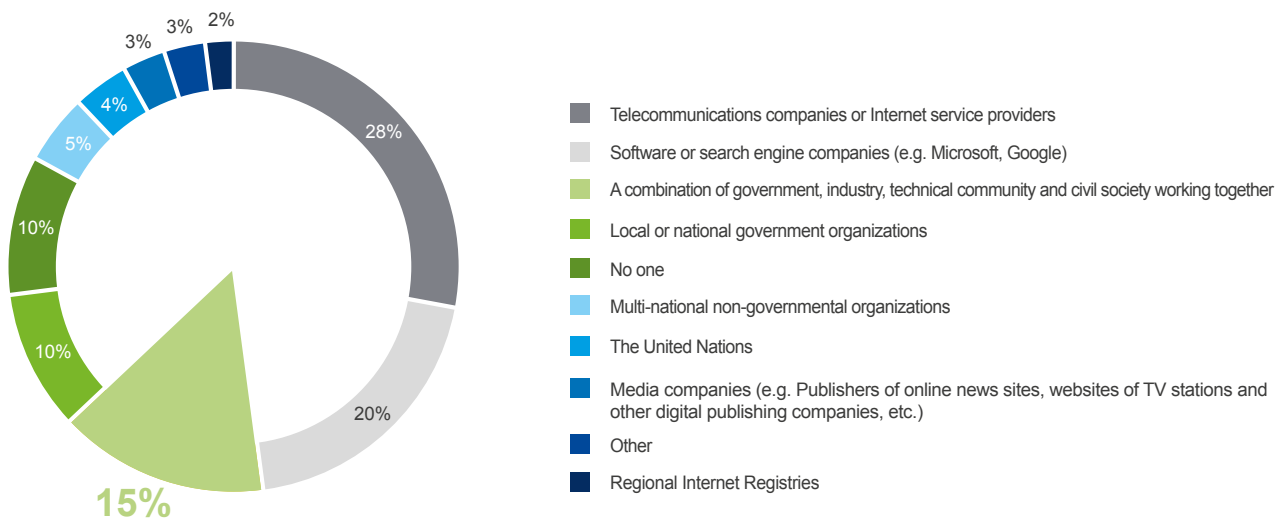
[Source: NTIA]

combination of government, industry, technical community and civil society working together” (see Figure 2.3). Clearly, it will be easier for the community to preserve and evolve the current model if it is better understood.

Figure 2.3: Survey results

Who do you think is responsible for managing the global Internet?

[Source: Internet Society, Global Internet User Survey, 2014]



Multistakeholder processes have been recognized as a way to provide the flexibility and agility necessary to develop timely, scalable, and innovation-enabling Internet policies. Inclusiveness, transparency, and collaboration are the fundamental pillars of the Internet model and must be nurtured to preserve the benefits of the open Internet and ensure that it remains sustainable.

Below we present a case study on how a group of stakeholders can coalesce to address important issues, in this case the proliferation of spam.

Case study: Combating Spam Project

Unsolicited bulk electronic communication, or “spam” as it is more commonly known, has significant economic and consumer implications. According to Kaspersky, nearly 70% of emails sent in 2013 were spam.¹⁰ In addition to the resources that end-users may spend to download and delete spam, the malicious web addresses and attachments often

present in spam can affect end users' computing devices. Combating spam requires a multistakeholder approach, including governments, the technical community, network operators, and end users. Recently, the Internet Society launched the Combating Spam Project, to share the spam mitigation expertise of developed world stakeholders with interested participants in developing regions.

The Combating Spam Project evolved from discussions at the 2012 World Conference on International Telecommunications (WCIT), where developing country governments expressed a need to combat spam, which wastes much-needed Internet resources, thus creating a significant impact on user costs and Internet accessibility. While the industry and global technical community have made great strides in creating best practices and developing the technical tools to combat unwanted forms of electronic communication, this information has not, in many cases, reached policymakers and the technical communities in developing regions.

The Internet Society's work in this area aims to help build capacity to address spam in developing regions with three programmes.¹¹ The first programme focuses on developing and collecting materials, documents, and interactive training modules on spam. The second part of the project is a series of workshops for policy makers, which presents best practices and operational tools while also establishing partnerships between experts and participants to work together to combat spam. The third part of the project is a programme that provides technical and operational training about spam mitigation to technical communities in developing countries.

Three workshops were held in 2013, in Kenya and Argentina, as well as a webinar targeted at the Latin American region. In total, 237 participants attended these workshops and gained concrete skills, knowledge, and strategies to effectively combat spam on multiple levels. Feedback from the participants included requests for additional assistance in the use of mitigation tools, along with more information on spam and what they can do to address the problem within their country and region. This feedback has been incorporated into the Combating Spam Project approach for 2014 and beyond.

Spam is a pervasive problem that requires global partnerships to mitigate its proliferation. The Internet Society's Combating Spam Project focuses on filling that gap by playing an active role in convening experts to help in the common global fight against the negative consequences of unsolicited bulk

70%

Estimated percentage of all emails sent in 2013 that were spam

[Source: Kaspersky]

electronic communications. In addition to fighting spam, the project demonstrates the value of partnerships and the multistakeholder process to create a sustainable model for engagement and problem solving.

Summary

Existing Internet governance arrangements have evolved organically and are based on a voluntary collaboration between the many actors in the Internet ecosystem. The distributed nature of these arrangements corresponds to the underlying Internet architecture and relies on a model that allows collaboration and exchange of information between actors that have diverse areas of expertise, knowledge, and know-how. This model is based on multistakeholder participation, in which all interested and relevant actors work together, as can be seen in the example of the Combating Spam Project.

2.3 Standardisation

Introduction

The Internet is based on open, globally accessible and applicable technical standards — communication protocols, data exchange formats, and interfaces — which allow different computers and networks to talk to each other. They are the global lifeblood for multibillion-dollar industries that did not exist 20 years ago. Standards are created in a collaborative, open process for which success is measured by the depth and breadth of their acceptance across a hodgepodge of vastly different technologies that together form the network of networks that is the Internet.

Internet standards are developed in response to the evolution and growth of the Internet, thereby further facilitating the exponential growth rates in adoption and usage. The processes by which these open standards are developed have matured along with the Internet. The development paradigm that has been successfully used to create those standards has emerged as an important piece of the Internet's widespread success.

Technology and its use evolve at a rapid pace, and standards must be able to develop accordingly in a flexible and scalable way. By allowing the community of Internet technology developers and users to create and experiment, build without requiring permission, and feed their real-world

experience back into the standards process, the open development paradigm supports the uniquely innovative character that is the hallmark of the Internet. The alternative – an imposition of mandatory standards by a governmental or standards body – runs contrary to this process, preventing or inhibiting standards from developing in response to fast-paced technological evolution and market needs.

From the beginning, the Internet’s creators understood that, in the absence of global and interoperable standards, networks would be fragmented and incompatible, isolated, and unable to communicate among each other. The technical community’s desire to develop an efficient system of communication has driven the creation of the Internet as we see it today. The achievement of these technical outcomes has not been easy; it continues to require constant commitment and re-examination of core values to remain relevant and effective. These core values underpinning the collaborative means of setting standards have recently been embodied in a new set of principles known as OpenStand.

7,259

*Total number of RFCs,
as of 20 May 2014.*

[Source: IETF]

OpenStand

In 2012, the IEEE, Internet Architecture Board (IAB), IETF, Internet Society and W3C — five organizations deeply involved with developing the technical standards the Internet runs on — affirmed a set of principles called “OpenStand”.¹² These principles define the characteristics of a modern standards paradigm that depends on the Internet’s diversity and flexibility, making technical excellence its primary focus.

The OpenStand principles offer a concrete picture of the process and philosophy behind Internet standards’ development:

- cooperation among standards organizations
- adherence to due process, broad consensus, transparency, balance, and openness in standards development
- commitment to technical merit, interoperability, competition, innovation, and benefit to humanity
- availability of standards to all
- voluntary adoption

In line with this ideal, the IETF Mission Statement highlights the fundamental value of an open model by stating:

*We embrace technical concepts such as decentralized control, edge-user empowerment and sharing of resources, because those concepts resonate with the core values of the IETF community. These concepts have little to do with the technology that's possible, and much to do with the technology that we choose to create.*¹³

The way standards are developed varies from one organization to the next, but OpenStand represents a shared commitment to open processes and consensus-based decision making that allows for transparency and balance. And, though the OpenStand announcement was made in 2012, this paradigm has been at the heart of the Internet's development from the outset. Since the announcement, companies and other organizations that build and use the Internet have added their support for its principles.

As the Internet continues to grow, it is increasingly important to recognize this approach's unique qualities and contribution to the Internet's overall success — and how it has been part of the equation for successful companies and organizations that use the Internet. The OpenStand approach has given us the building blocks to create previously unimaginable services and opportunities to interconnect the world's population. By tapping into the world's greatest engineering talent, and more directly translating those talents into technical solutions, it creates the platform that generates innovation for everyone.¹⁴ Below we present a case study of how the OpenStand principles work in practice.

Case Study: Opus

The Opus audio codec is an excellent example of how standards developed under the OpenStand paradigm are key to the Internet's future development.¹⁵ An audio codec is needed to translate analogue audio into digital streams for delivery, which are then turned back into analogue audio for listening. This enables users to send and receive audio signals, including voice and music.

A notable characteristic of codecs is that the same standard is required at both ends – thus, the more users there are, the more beneficial the codec. In economics, this phenomenon is known as a network effect. In this situation, a common standard, such as one developed using OpenStand principles, is beneficial as it ensures that the standard meets a broad range of needs and is widely adopted as a preferred standard, thereby delivering the greatest network effects.

More and more audio is moving to the Internet, ranging from voice-over-IP (VoIP) services to high-quality audio streaming. As such, a codec that covered a wide range of uses – measured by frequency ranges – is most useful. Further, audio is delivered over a wide range of access technologies, and thus a codec that adapts to the amount of available bandwidth is important. The Opus codec is the result of addressing both these challenges, thereby ensuring high-quality audio at varying bandwidths.

The development of the Opus codec was initiated by several companies including Skype, which had started to develop its own variable-rate speech codec named SILK in 2007. At the same time, Xiph.Org contributors had been working on the CELT codec, an audio codec aimed at the most demanding audio applications. The SILK and CELT codecs were in many respects perfect complements to each other, which led to the creation of a hybrid mode that would later become the Opus codec.

In 2010, a prototype of the hybrid was developed and submitted to the IETF as a proposal for standardization. After more than two years' work, the Opus codec was finally published as a RFC in September 2012 under the name RFC 6716.¹⁶ To date, it has been adopted as the required audio codec within WebRTC,¹⁷ resulting in support in Google Chrome, Mozilla Firefox, and other browsers that support WebRTC. Additionally, it is supported in several open-source softphones and a variety of audio players.¹⁸

It is worth noting that the Opus codec not only meets the technical demands for different services delivered over varying bandwidths, as shown in Figure 2.4, but it is also royalty-free to ensure open and equal access to a core Internet technology. While other codecs share these technical characteristics, they are proprietary and patent-protected.

The story of the Opus codec illustrates how the development of open standards is closely linked to its implementation, through a feedback loop. Through the multistakeholder approach, a key technological standard can be created with the input of preferences from a broad set of actors, which in turn are the users of the same technology. This ensures that the technology adheres to the requirements of a variety of applications, and the applications are interoperable. The fact that the standard is royalty-free and accessible to anyone increases its use as a standard and enables innovators to build on an existing framework.

RFC 6716

Definition of the Opus Audio Codec

[Source: IETF]

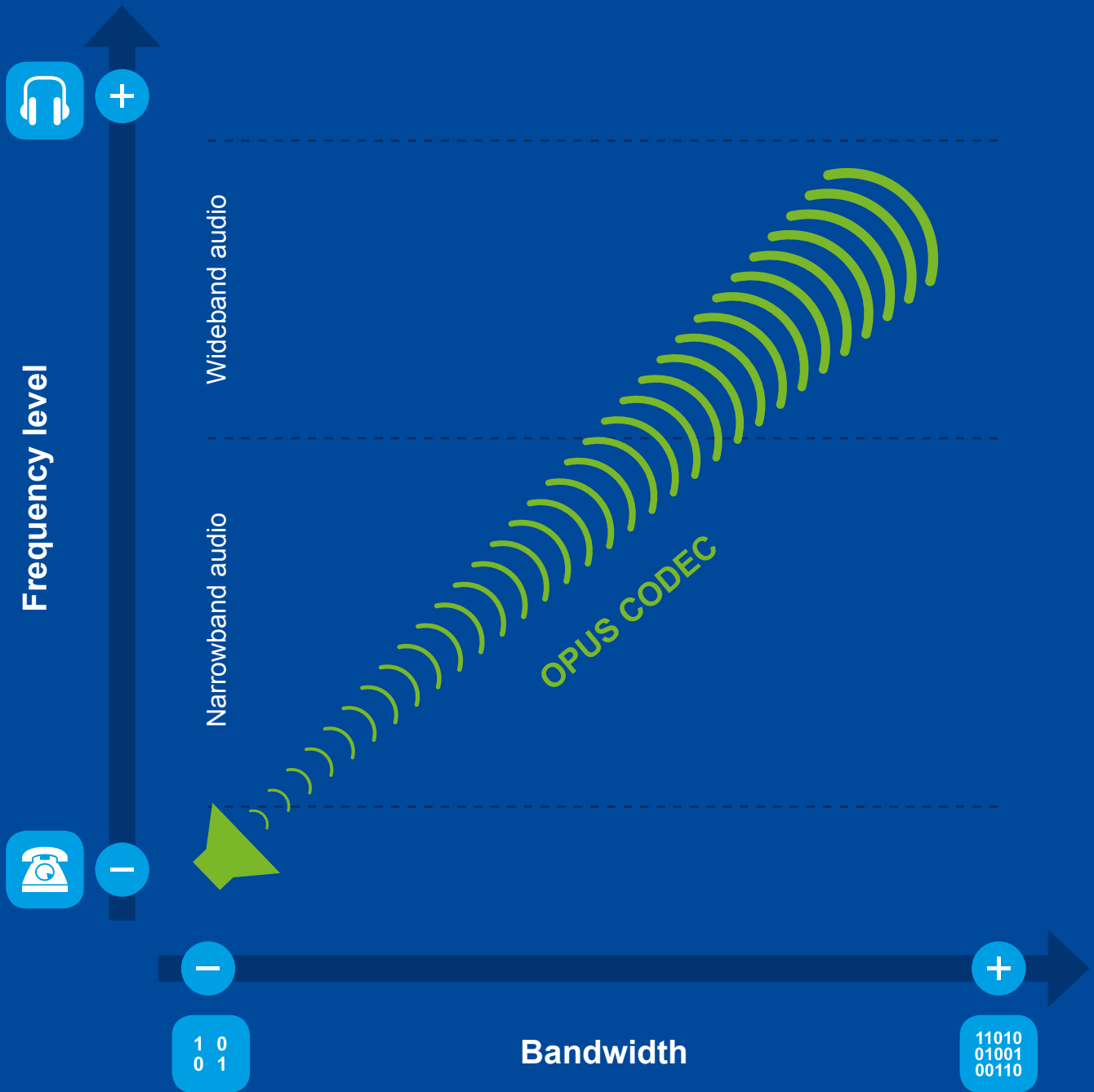
Figure 2.4: OPUS Codec case study

[Source Internet Society, 2014]

The Opus Codec automatically adjusts to the bandwidth environment. Trading sound quality for speed, the codec allows for communication across different connection speeds at a minimum delay.



The result is a optimization of audio quality. If the bandwidth level goes down, Opus narrows the frequency range that is transmitted, and conversely increases the frequency range if the connection improves.



Summary

On many levels, the Internet is about uniting diversity — bringing together communities of people with common interests, while enabling independent networks to communicate through established technical protocols. Those protocols, in turn, are developed by people, collaboratively, as open Internet standards. Standards developed with global input from a diversity of sources through open processes have the greatest chance of producing outcomes that are technically exceptional, leverage cutting-edge engineering expertise, and support interoperability and innovation in technology markets.

2.4 Smart Development

Introduction

While much of the deployment of Internet infrastructure is undertaken by private operators, or governments, there are examples in which the open multistakeholder approach is well suited to the physical development of the Internet. At the Internet Society, we refer to this approach as Smart Development, which recognizes that the most effective Internet development programmes do not simply involve deploying equipment, but have always been built on three fundamental pillars:¹⁹

- *Human infrastructure* – The trained, educated, and engaged technologists who create, populate, and maintain networks at a local and regional level
- *Technical infrastructure* – The networks, connections, routers and other hardware on which the Internet runs, and through which the unconnected become connected
- *Governance infrastructure* – The frameworks, guidelines, and rules that promote Internet use, innovation, and expansion

Smart Development simply describes an approach that incorporates all three of those pillars, putting individual stakeholders, communities, nations, and regions in the best possible position to achieve success and sustainable Internet engagement. We now provide two case studies of how Smart Development can help to fill gaps in access and connectivity.

61,753

Internet Society Members

18 May 2014

[Source: Internet Society]

Case study: African Internet Exchange System (AXIS)

An example of Smart Development in action is the Internet Society's partnership with the African Union (AU) to implement the African Internet Exchange System (AXIS).²⁰ This partnership continues a critical process that the Internet community has successfully implemented for more than twenty years – building bottom-up communities that sustain technology and, in particular, Internet Exchange Points (IXPs).

IXPs play a critical role in routing traffic more efficiently, by enabling local Internet service providers (ISPs) to exchange traffic directly with one another in the country, rather than doing so indirectly over international transit links. This has the benefit of reducing the latency of traffic exchange, as it does not have to travel outside the country, and sometimes the continent, to be exchanged, while also saving money that was being spent on international transit links.²¹

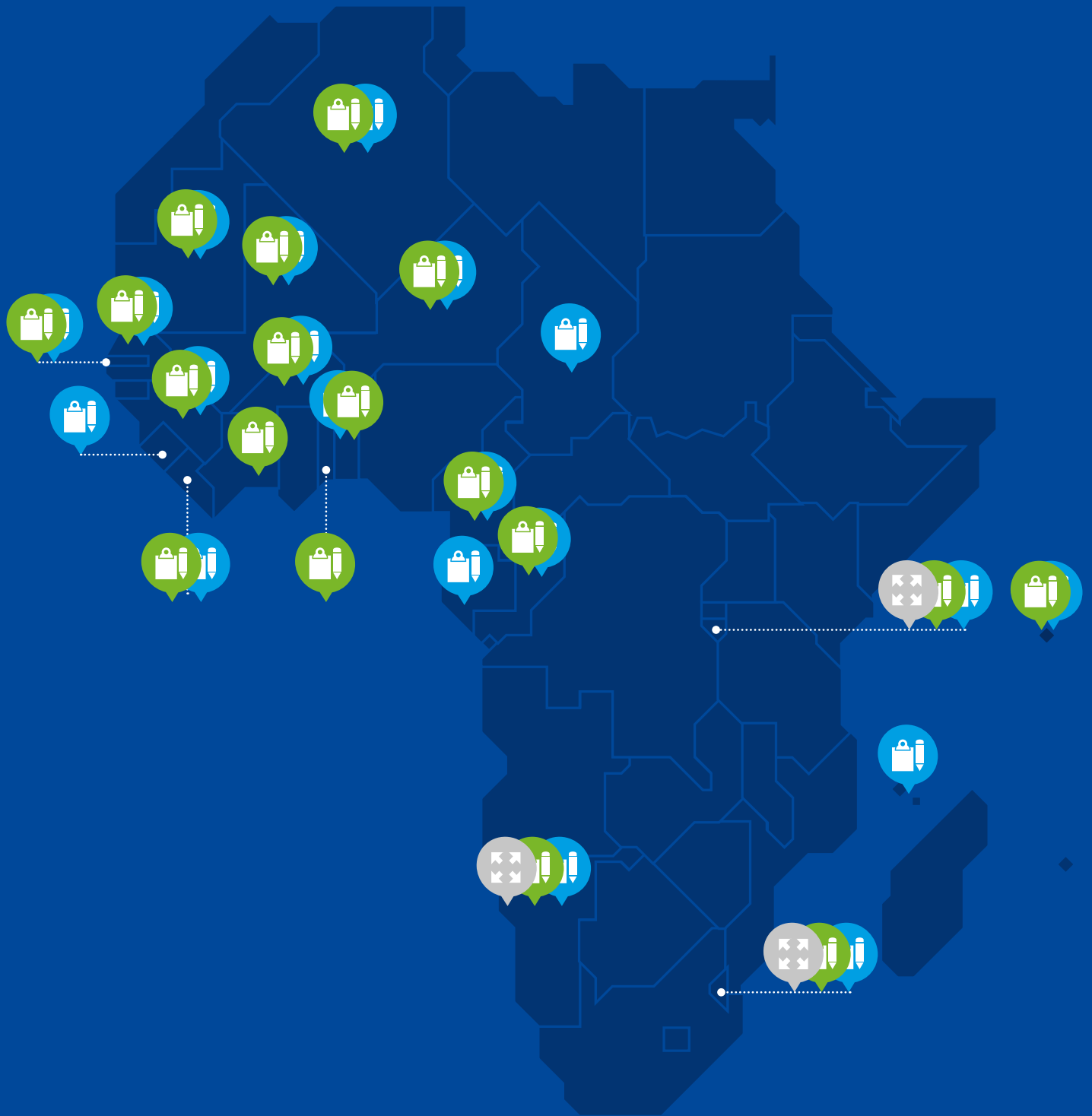
This grant project with the AU and stakeholders across Africa aims to conduct sixty Best Practices (BP) and Technical Assistance (TA) workshops in thirty African countries over two years. AXIS aims to reduce Internet traffic costs, build African expertise, and facilitate additional services and content development. At the local level, AXIS aims to build the critical communities that sustain an IXP, provide stakeholders with training, and build the local Internet infrastructure to keep “local traffic local”.

By marrying resources and expertise, and by working with key technical experts from the IXP and Internet technical community (including AfriNIC, Lyons-IX, France-IX, and Jaguar Networks), this project implements the Smart Development approach:

- it trains people and builds capacity (human infrastructure)
- it lays the groundwork for Internet infrastructure development and technical upgrades to existing infrastructure (technical infrastructure), and
- it works with stakeholders to ensure a participatory and bottom-up sustainable buy-in for IXP development and to implement best practices for IXP governance and management (governance infrastructure).

Figure 2.5: AXIS workshops

[Source: Internet Society, 2014]



● Best Practice Workshops ● Technical Aspects Workshops ● New IXP Opened

Since mid-2012, the Internet Society African Regional Bureau and Internet community experts have conducted 22 BP workshops and 15 TA workshops. The impacts of the workshops have included: raising awareness about international best-practices and core community building in countries; educating government officials about the important role of the technical community in managing and running IXPs; and providing a platform to continue a dialogue that will allow for IXP development in targeted countries.

The map in Figure 2.5 details the workshops that have taken place to-date, which cover both best practices and technical aspects of setting up an IXP. A recent success from this initiative was the opening of the first IXPs in both Namibia and Burundi in March 2014, one in Swaziland in April 2014, with another scheduled to open in the Gambia in July 2014.²²

As the Internet Society's African team and expert partners continue to provide training throughout 2014, the team will augment its activities through funding provided by an IXP Toolkit & Best Practices grant provided by Google.org,²³ and bolstered through an equipment grant from Cisco Systems as needed.²⁴

Case study: *Wireless for Communities (W4C)*

Last-mile Internet connectivity is typically provided by a for-profit private operator deploying fixed or mobile service. In rural areas, where it may be difficult or impossible to cover costs, much less generate profits that attract investment, government funds may support private deployment (often via a universal service fund) or the government may deploy its own service. The W4C initiative in India shows a third way, focused on community deployment for community usage, leveraging a Smart Development approach that has yielded significant success in bringing new populations online.

The Internet Society, along with the Digital Empowerment Foundation (DEF), started the W4C initiative in 2010.²⁵ This initiative focuses on providing assistance on how to establish and operate community wireless networks using Wi-Fi technology, while also training the local community in Internet use, digital literacy, and micro-entrepreneurial skills.

The pilot programme was initiated in Chanderi, India, a small rural town with a population of 40,000, 40% of whom are illiterate. Before 2010, there were no computers in Chanderi, until a 'digital design resource centre' was set up to provide training and the first Internet access. The resulting W4C network covers a radius of 5 kilometres, and today 11 out of 13 schools have Wi-Fi connections, as do several computer centres, hotels, and private homes. The network boasts 50 nodes in total, and 1,563 users.

The W4C initiative has moved to six more communities in India, with a total of 4,025 new Internet users, alongside a cadre of trainers who have been trained in deploying networks to ensure that the system can expand further. These citizens now have access to a number of e-government initiatives, as well as the possibility to sell their goods beyond their customary markets. For instance, Facebook hosts an active market for traditional Chanderi saris.²⁶

Summary

Smart Development represents a positive, inclusive, and proven alternative to top-down efforts to spur development through prescriptive regulatory fiat. It offers an apolitical, non-interventionist method of building Internet connectivity and engagement that is accessible anywhere in the world, and delivers documentable, cost-effective, and replicable results. In short, Smart Development provides the tools to transform non-users into users, users into creators, and creators into innovators.

2.5 Conclusion

The Internet has evolved from its creation as a research network to become a ubiquitous platform, with an influence that extends far beyond basic data communication. Human networks of trust were established among Internet technical experts, and the Internet infrastructure grew and proved its resiliency. However, these principles are not limited to the development of technological standards; they also provide a basis for understanding how the Internet is governed and how bottom-up development can occur.

By virtue of the fact that the Internet ecosystem has been created by multistakeholder efforts, the open processes that have enabled the Internet's evolution and growth have also acted to ensure the Internet itself remains open for end users. As a result, the Internet is as open for usage as it is for development and governance, in an infinite loop of evolution and growth.

As such, openness represents the very essence of the Internet's success and must be preserved and encouraged to allow end users, businesses, and governments to reap the benefits of the Internet, as described in the following section. As such, all Internet stakeholders need to work together to protect and promote the open Internet and the underlying principles of multistakeholder Internet governance.



SECTION 03

Benefits of an Open and Sustainable Internet

3.1 Introduction

The open Internet has become a medium like no other, one that merges the most notable characteristics of traditional media such as broadcast and telecommunications, while also augmenting them in ways that have revolutionized aspects of civil society, business, and government.

Before the Internet, traditional mass media such as television and newspaper were the main means through which a large number of people could be reached. These mass media have a number of important characteristics, however:

- First, they are 'one-to-many', allowing the owner, be it a business or government, to broadcast content to viewers, listeners, or readers
- Second, they are mainly 'one-way', in that they do not allow for a return path for the receivers of the broadcast to communicate back to the originator over the same medium
- Finally, these media essentially are limited to a national reach, for commercial reasons or due to license conditions.¹

Telecommunications, on the other hand, differs from traditional mass media in several key ways.

- First, telecommunications are 'one-to-one', allowing any user to call any other user (or at most 'few-to-few' with conference calls)
- Second, they are 'two-way', allowing the originator and receiver to communicate with one another equally
- Finally, telecommunications is global, with any user able to call any other user.



2,153,212,834
*Total edits in Wikimedia
Projects (including Wikipedia)*
20 May 2014, 13:00 CET

[Source: tools.wmflabs.org/wmcounter/]

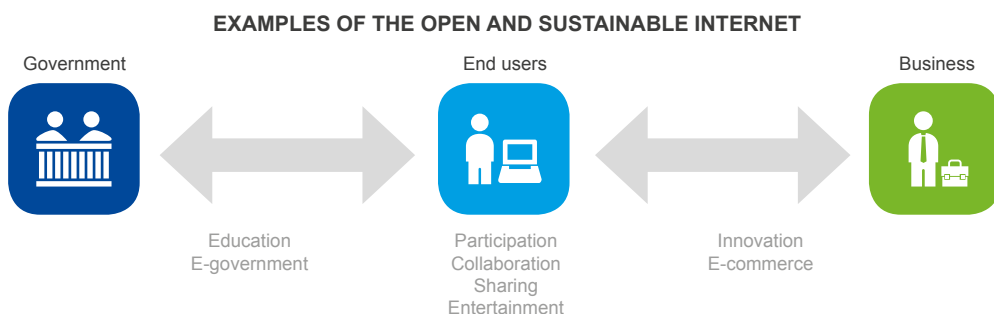
The open Internet is an amplified combination of these two media. As with mass media, it allows one-to-many broadcasts, such as websites or blogs; and as with telecommunications it allows one-to-one communications, such as email or instant messages – in both cases on a global scale. However, it also enables a new mass media paradigm of ‘many-to-many’, allowing communications between and among all Internet users, as well as more targeted ‘some-to-some’ collaboration between users with common interests or goals.

As a result, the nearly 3 billion Internet users are both creators of information as well as consumers. Websites, blogs, videos, and tweets, can all be broadcast and accessed in the largest mass medium imaginable. Audio and video calls and conferences can be set up and received without regard to distance or cost.

However, these interactions are not just limited to traditional media. Governments can use the Internet to deliver services and levy taxes, and in turn can choose to enable citizens to elect, petition, and oversee their governments online. Entrepreneurs not only have new markets for their goods or services, but also a new means to raise money online to finance their dreams. Likewise, entertainers have a new global medium to share or sell their endeavours, while new artists can be discovered and grow online. See Figure 3.1 for an overview of the examples in this section.

Figure 3.1: Section overview

[Source: Internet Society, 2014]



With open access to the Internet and an appropriate enabling environment, the resulting benefits of the Internet are limited only by the imagination and efforts of its users. Here we provide some examples that demonstrate the value of the open Internet for creating benefits among the global users of the Internet.

Conversely, as we show in the following section, differences in user experience across countries, whether based on the digital divide, or based on limited access to content and applications, reduce these benefits for all users.

3.2 The Internet is Open for Education

One of the most notable trends in recent years is the increased focus on the Internet as a platform for education. The Massachusetts Institute of Technology (MIT) jump-started the movement in 2001 by introducing the OpenCourseWare project to put their course materials online, beginning in 2002.² Subsequent to MIT’s announcement, UNESCO held a forum on open courseware in 2002 where the term “Open Educational Resources” was coined, adopting the following definition: “The open provision of educational resources, enabled by information and communication technologies, for consultation, use and adaptation by a community of users for non-commercial purposes.”³

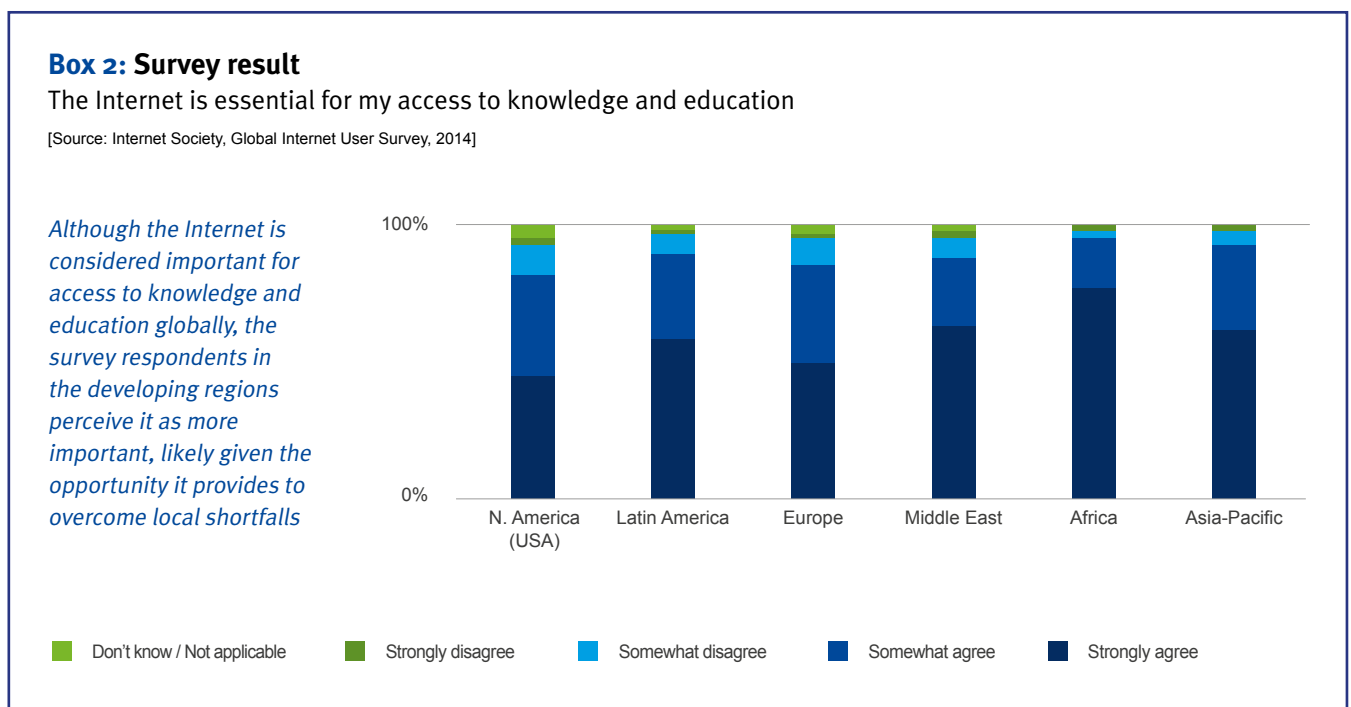
152,347,354

Total online visits to MIT OpenCourseWare as of March 2014.

[Source: MIT OpenCourseWare]

Significant work has gone into open educational resources since 2002, with a number of universities around the world joining MIT in publishing courseware, and UNESCO continuing to be active in promoting this movement. As of 2014, MIT announced that it has published materials from 2150 courses. At the primary and secondary level, Bangladesh digitized all textbooks and has made them available online for free.⁴

More recently, Massive Online Open Courses, commonly referred to under the acronym ‘MOOCs’, have emerged. These courses broadcast classroom lectures, either in real time or via streaming, and can be standalone or part of a more traditional course that includes homework and exams.



The separation of teacher and student in time and space is not new. Early examples of organized forms of distance education can be traced back as early as the 1840s and the Phonographic Correspondence Society that offered courses in shorthand writing through postcards. Postcards may have been replaced by bytes, but the core remains, of lessons delivered through a contemporary means of communication to increase the reach of education.

In both cases, education adapted to new means of access. The development of distance education in 19th century England was, for example, enabled by the so-called ‘penny post’, a reform that cut the cost of postal services for the large public. Likewise, online education benefits from the decreasing costs of Internet access worldwide, which has broadened the potential student base – just as in the case of the penny post.

The difference today is the scale, as seen in Figure 3.2. Where the old form of distance learning was confined to a national or regional student base, the Internet is global. Students who used to be restricted by geographical or economic constraints are now able to attend classes provided by the top-tier universities in the world, regardless of where they live.

The relationship is mutually beneficial – students get access to top education, and universities get access to a student body that may contain the next Einstein. A good example of this relationship is the story of Battushig Myanganbayar, a 15-year old from Mongolia who was discovered and accepted at both UC Berkeley and MIT after obtaining a perfect score in MIT’s online class “Circuits and Electronics”.⁵

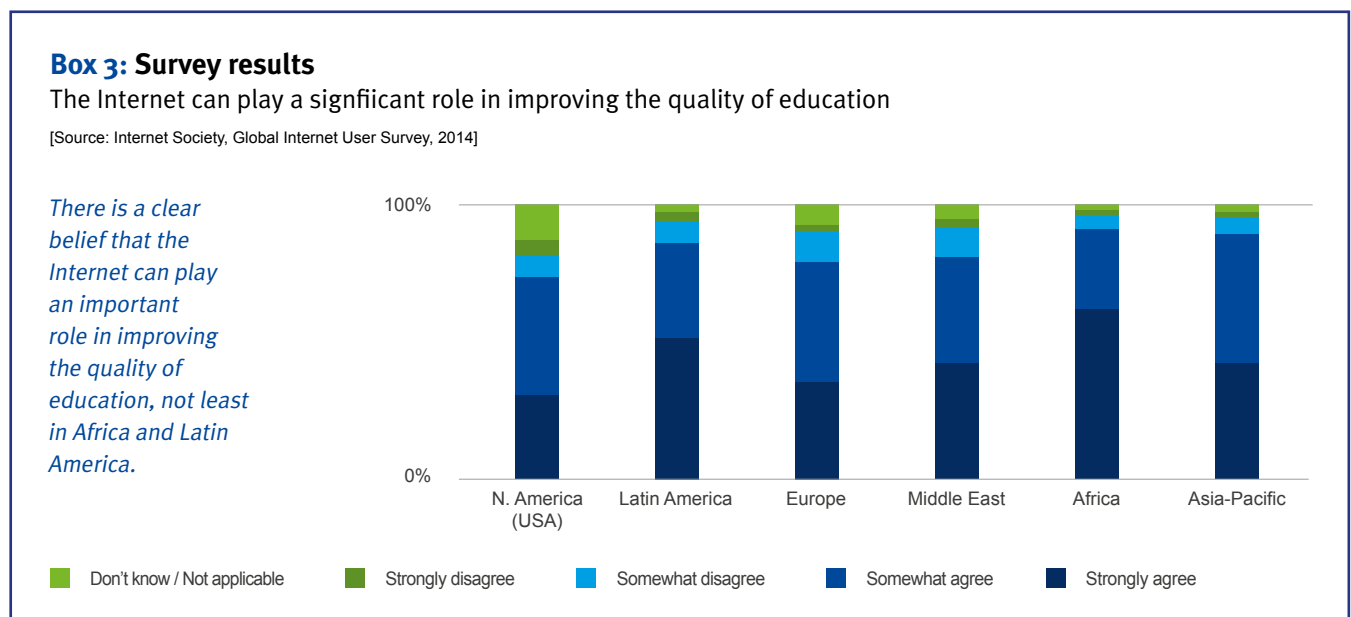
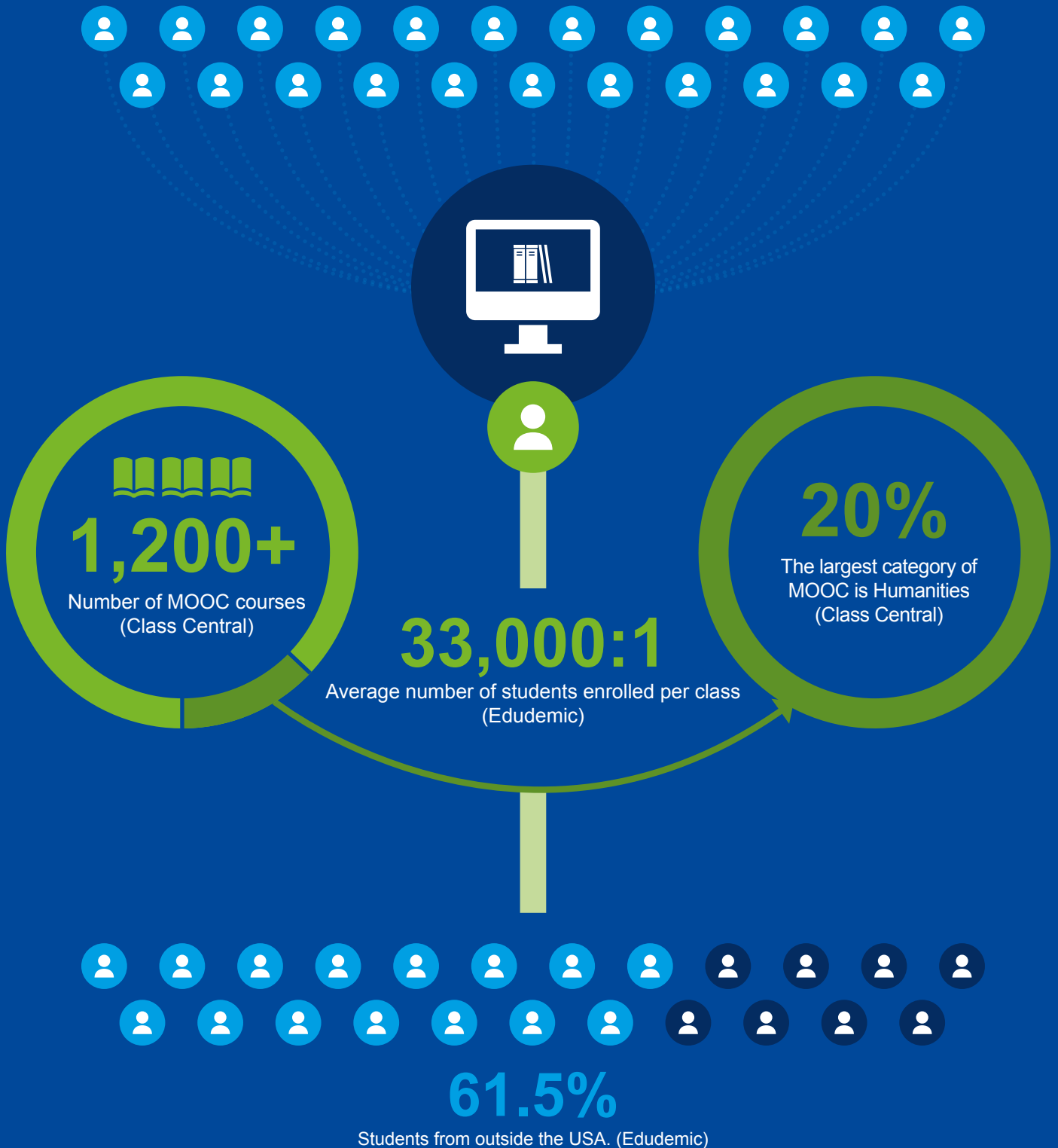


Figure 3.2: Massive Online Open Course Statistics

[Source: Internet Society, Class Central, Edudemic, 2014]

10 million

Students who have registered for MOOCs (Class Central)



The demand for online education is only likely to increase. For example, UNESCO has estimated that 80 million additional people will be seeking higher education by 2025.⁶ To meet this increasing demand with traditional campuses, three new universities, accommodating 40,000 students each, would have to be established every week for the next 12 years. Online education is able to meet this demand in theory, but in practice it is still evolving.

Online education is an efficient means of reaching a global audience, because the production and delivery exhibits economies of scale – once the course is developed, there is little additional cost of delivering it multiple times, anywhere in the world. As a result, the cost to the students can be lower than a traditional education, to the extent that the provider wishes to charge fees.

Language may be an issue, however. Many universities providing MOOCs, for instance, are predominantly American with English being the primary language for course production, irrespective of country of origin. This present dominance, together with a business model inherently linked to economies of scale, may thus consolidate English as the lingua franca of online education, creating a potential language as well as cultural barrier to participation.

Finally, the underlying hurdle to overcome in order to make online education viable an alternative to traditional forms of education around the world is technical. In particular, in addition to the basic reach of Internet access, the bandwidth of the connection is important to enable live-streamed lectures or videoconferences used in the teaching. Without the required speed, it is simply not possible to participate in elements of the course.⁷

Summary

While it is true that the challenges of online education have not all been met, it is equally true that the opportunities would not be possible without the open Internet. As the digital divide is bridged, educational opportunities will increase in underserved markets the world over, at lower costs. The students reached through these efforts will no doubt make their mark on all endeavours, including new innovations that will continue to enable the Internet to grow and remain sustainable.

As noted recently by Hal Varian, Chief Economist for Google:

The biggest impact on the world [of the Internet-enabled revolution in education] will be universal access to all human knowledge. The smartest person in the world currently could well be stuck behind a plow in India or China. Enabling that person – and the millions like him or her – will have a profound impact on the development of the human race. Cheap mobile devices will be available worldwide, and educational tools like the Khan Academy will be available to everyone. This will have a huge impact on literacy and numeracy and will lead to a more informed and more educated world population.⁸

3.3 The Internet is Open for Government

A number of governments have chosen to conduct elements of governance and the democratic process partially, or entirely, online. This starts with campaigns and elections and allows the electorate to continue their involvement and influence over government behaviour through petitions and other means of online engagement. Additionally, a large number of countries now have online portals for paying taxes to provide funding for government functions, and many offer a wide and growing variety of e-government services online.

The wide reach and many-to-many communication properties of the open Internet make it particularly well suited to these purposes. Of course, governments must choose to create an enabling environment for citizen engagement, and in turn citizens must have access to the Internet and appropriate online literacy to use these services.

Online political campaigns

Election campaigns are increasingly run online. Google has sought to assist voters in researching their choices by developing a Politics and Elections hub, which launched during the run-up to the 2012 USA election.⁹ The page aims to group online resources related to the candidates and election in one place, making resources easier to find and review. Information provided included trend data on Google searches, Google News mentions, and YouTube video views for each candidate, giving an indication of their popularity.

While initially targeting the USA election, the site has since covered elections across a number of countries, including Chile, Japan, and Australia. As shown in Figure 3.3, for the Chilean election, the resulting search term data gave insight into the election race, which was won by Michelle Bachelet on 15 December 2013.

The Italian MoVimento 5 Stelle (M5S) movement is an example of a political party that has taken advantage of online campaigning in the run-up to the 2013 general election in Italy. The party was launched in 2009 in response to the corruption being reported in Italian politics and advocates participatory democracy, including e-democracy. To this end, the party engages with supporters online, incorporating their opinions in decision-making to make them active participants rather than passive followers.

Figure 3.3: Indexed volumes of searches for the presidential candidates in the 2013 Chilean election

[Source: Google Trends, 2013]

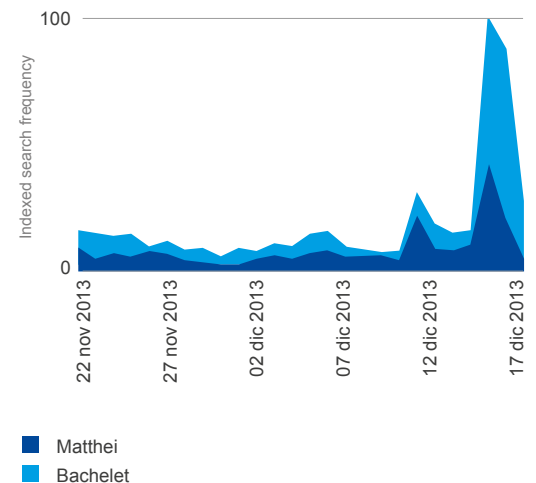
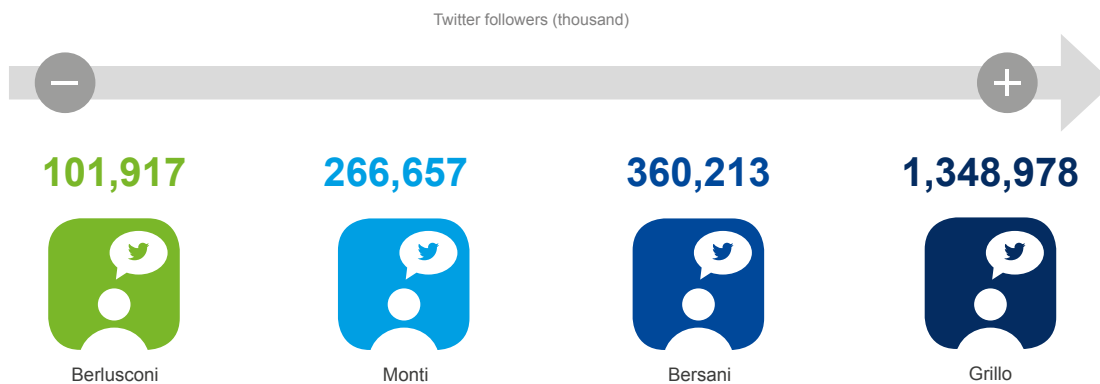


Figure 3.4: Twitter followers of candidates in the Italian presidential election, in December 2013

[Source: Analysys Mason, 2013]



The e-democracy was put into practice in the M5S primary election, which was conducted entirely online. In that election, 95,000 virtual ballots were counted to select the party's candidates for the General Election and the party leader, the comedian Beppe Grillo, stated afterward that this was done "at zero cost – we didn't even spend a euro".¹⁰

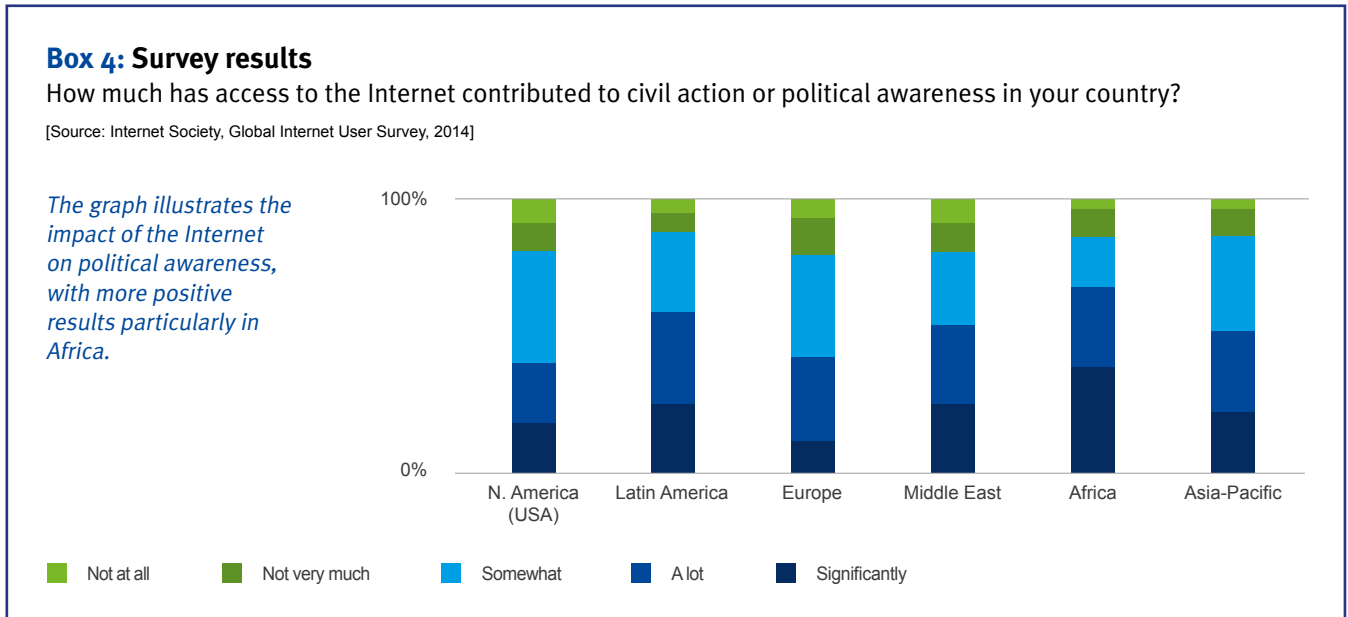
The party also operates an online TV channel¹¹ and Beppe Grillo's blog,¹² which can be used by potential voters to interact with him, is the most widely read in Italy.¹³ On Twitter, he has around four times the number of followers of any of the other presidential candidates for the election, with over 1.3 million, as shown in Figure 3.4.

Similarly, Grillo has over 1.4 million likes for his Facebook page. A survey of 2,245 of these followers, conducted by Demos, found that 20% of the respondents say they are 'formal members of M5S',¹⁴ indicating that the movement has likely been successful in moving its supporters beyond simply following the party via social media and on to formal party membership.

Partly as a result of this online campaigning, the party was able to go, in four years, from launch to receiving 25.5% of the popular vote in the 2013 election, thereby achieving more seats in the House of Deputies, 108, than any other single party.¹⁵

Online elections

While the M5S party conducted its primary election over the Internet, several governments have also begun to experiment with online voting for the national election. While India, Kazakhstan, Brazil, and the Philippines have used some element of electronic voting in past elections, the majority of electronic voting to date has been in Europe and North America.

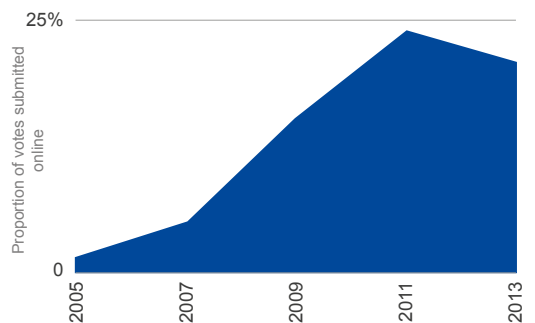


Estonia was the first country to host legally binding elections over the Internet when it ran a pilot scheme during the 2005 local elections. The success of this scheme encouraged the country to continue using online voting for the 2009 and 2013 local elections and the 2007 and 2011 parliamentary elections. Online votes can be submitted at any time during the early voting period and can be changed an unlimited number of times, with only the final submission counted. As can be seen in Figure 3.5, the proportion of votes generated online is now in the region of 20% of total votes in Estonia.¹⁶

Figure 3.5: Proportion of votes generated online in the Estonian elections, 2005–2013

[Source the Estonian National Electoral Committee, 2013]

The rapid uptake of online voting in Estonia can be explained in part by the fact that, as of 19 December 2013, approximately 1.21 million of the 1.34 million inhabitants possess a national ID card that enables secure remote authentication and can provide a legally binding digital signature.¹⁷ This type of ID card, with its many possibilities for online activities, does, however, raise a few concerns regarding security and privacy.



Online lobbying and campaigning for change

Once a government or parliamentary representative has been elected, the Internet provides channels for the electorate to continue to influence policy and hold its elected officials accountable. These channels can be both government-run, as discussed in the examples below, or privately run, as discussed in the following sub-section.

Both the UK and USA governments operate e-petition sites that respectively will put an issue forward for debate in the UK House of Commons or receive an official response from the USA government, if sufficient signatures are received.

The UK site allows any e-petition that receives at least 100,000 signatures to be considered for debate. For instance, a petition to reconsider the decision to award the West Coast Mainline rail franchise¹⁸ to FirstGroup was allocated a debate slot on 17 September 2012.¹⁹ This petition (along with court proceedings commenced by another competitor for the franchise, Virgin Trains) led to the overturning of the decision to award the franchise and the reopening of the competitive bid process.²⁰

The White House also runs an e-petition site that seeks to promote the First Amendment right to petition the government.²¹ With enough support, White House staff will review the petition, ensure that it is sent to the appropriate policy experts, and issue an official response. As of January 2013, 100,000 signatures in 30 days is the threshold for consideration. These petitions can be serious policy issues, such as the question of reform of the banking sector,²² or more frivolous ones, such as the August 2012 request for the release of the White House beer recipe²³ or the November 2012 request to secure resources and funding and begin construction of a Death Star from the movie *Star Wars*.²⁴

Tax administration and collection

The Internet can also be used for running various aspects of government, particularly taxation. The Kenya Revenue Authority (the Kenyan tax collection agency) has migrated much of its activities online. Kenyans can use the site to file tax returns, and businesses can interact with customs for declarations of goods and imports.²⁵ Similarly, in the UK much of the tax system can be managed online, and on 5 December 2013 the Chancellor of the Exchequer, George Osborne, announced in his autumn statement that from October 2014, the tax disc to show motorists have paid vehicle excise duty is to be entirely replaced with an electronic system.²⁶

E-government

E-government initiatives are an area of increasing interest for governments and the public, given their potential to revolutionize how governments use technology to provide public services more broadly and with greater efficiency. E-government covers a multitude of services. For example, in the Asia-Pacific region, e-government initiatives have been explored since the mid-1990s to enable governments to spearhead various initiatives of national interest, including poverty reduction, mass education, universal healthcare services, anti-corruption drives, open governance, and promoting business and investments, among other topics.

The spread of these initiatives has been fostered, and studied, by a variety of organizations. For instance, the World Bank has an Open Government Data Toolkit, which provides resources and describes the benefits of Open Government initiatives.²⁷ Waseda University in Japan has an Institute of e-government, which ranks e-government programs based on a variety of indicators such as the digitalization of citizen consultation, taxation, and the electronic provision of social security services.²⁸

Singapore has long been at the top of the Waseda ranking and was recognized as the leading country in 2013.²⁹ With long-term strategies of continuously developing new digital solutions for the provision of public services, the government has implemented a series of e-government master plans, the latest of which is eGov2015, and initiatives include the OnInBox, which replaces hard-copy correspondence from the government.³⁰ To support the overall approach, the Infocomm Development Authority of Singapore (IDA) has “a national role to identify and facilitate the adoption of infocomm technologies to enhance Singapore’s competitiveness” across a variety of key sectors including education, healthcare, and government.³¹

Summary

The use of the Internet for campaigning, accountability and government financing is a growing trend, empowering citizens and facilitating greater efficiency and reach of government services. However, as discussed further in Section 4, some governments have chosen to block or filter access to certain content and applications, discouraging or forbidding citizens from participation, while in other countries, governments’ efforts to leverage the Internet may be slowed by a digital divide preventing citizens from going online.



Stated cost for MoVimento 5 Stelle party to hold primary online, in which 95,000 ballots were cast.

According to party leader Beppe Grillo

3.4 The Internet is Open for Participation

As discussed in the previous section, governments can host petitions to garner feedback and suggestions from citizens. However, the Internet enables citizens to participate in ways beyond those encouraged or even allowed by national governments.

In particular, the Internet can act as a digital Speaker's Corner, allowing users to air grievances, gather support, organize, and take collective action, creating a global version of Hyde Park. The activism can target local, national, or international issues, and focus not just on governments but also businesses.

Online advocacy

Online advocacy is not limited to local organization and politics, with a number of websites in existence that host international petitions relating to a range of topics, from climate change and corruption to the policies of retail companies and television programming schedules.³²

For instance, Avaaz was launched in January 2007 as an international citizen's group and it has seen a rapid increase in membership. It campaigns in 15 languages across 194 countries, and in the words of The Guardian newspaper in the UK, "has exploded to become the globe's largest and most powerful online activist network".³³

From its January 2007 launch to December 2013, Avaaz has been involved in 166 million 'actions'.³⁴ These have included fighting corruption in India, Italy, and Brazil; protecting the world's oceans, rainforests, and endangered wildlife; and defending Internet and media freedoms.

Change.org is another organization that facilitates online advocacy; since its February 2007 launch it has grown to a user base of over 40 million across 196 countries.³⁵ While it is open for anyone to start a petition about any local or international issue, the site is funded by running advertisements or sponsored petitions for not-for-profit groups and political campaigns, such as Amnesty International.

One case, with a national business focus, in which change.org was able to influence the outcome, was that of Bank of America's proposals to introduce a USD5/month

35,739,246

*Avaaz members
worldwide*

20 May 2014 13:30 CET

[Source: Avaaz]

banking fee to their USA customers. In October 2011, a 22-year-old American nanny, Molly Katchpole, started a petition that received over 300,000 signatures, including that of President Barack Obama. By November 2011, the proposed fee was cancelled.³⁶

Additionally, independent sites are using the Internet in an attempt to fight corruption and keep politicians honest. The ipaidabribe.org initiative was developed in India, by the not-for-profit organization Janaagraha, and allows citizens to report on the details of any acts of corruption they encounter. ipaidabribe.org uses these reports to argue for improving governance systems, procedures, and regulation to reduce the scope for corruption. From the launch of the site in August 2010 to December 2013, 18,000 Indians have reported paying bribes with a total value of INR592 million (USD9.5 million).³⁷ This initiative has been adopted elsewhere, operating in 11 countries at the end of 2013 and is expected to arrive in 12 further countries in the near future.

In Cambodia, the Cambodian Center for Human Rights (CCHR), which promotes democracy and protects human rights in the country, has become a good example of how advocacy can be made effective using the Internet and its outreach activities.³⁸ CCHR's progressive outlook and innovative management has also garnered it many awards and recognition from the international community.

The organization's project Sithi.org is a good example of how the Internet is an important tool to gather and spread information about the human rights situation in Cambodia. By collecting reports from human rights activists, organizations, and even regular citizens from across the country, the project has created a unique database of human rights violations. Through a simple online reporting system, registered users can file reports and provide detailed information of the nature of the abuse. This provides important information about the extent of violations in general but additionally identifies types of abuse and if there are sector-specific problems.

Internet-assisted engagement

In the 2011 uprising in Egypt that resulted in the resignation of President Mubarak on 11 February 2011, the Internet in general, and social media in particular, was used for a number of purposes including spreading awareness of the issues, organising the protests, and acting as an alternative

press to report on the details to the wider world. Egypt is one of a number of countries in which activists made use of the Internet to further their cause during the Arab Spring and beyond.

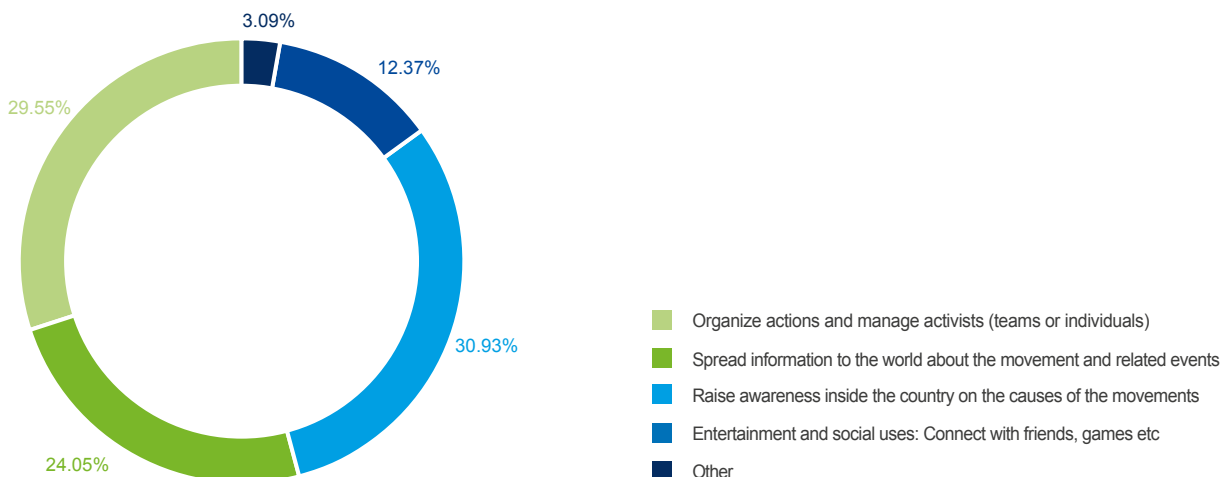
Of particular note in raising awareness of the plight of the Egyptian people under President Mubarak was the creation of the Facebook group ‘We are all Khaled Said’³⁹ in July 2010, after the young blogger was arrested and beaten to death by police officers. This became a prominent platform for dissemination of information on the case and the government’s response. At the peak of its popularity, the group had over 400,000 members and was used to spread word of the planned protest in Tahrir Square on 25 January 2011.

In response to these protests, the Egyptian government shut down the Internet access services in the country on 26 January 2011 (see Section 4.2 for more examples of government shutdowns). In order to maintain the ability for Egyptians to continue communicating with the rest of the world and report events on the ground, engineers at Google and Twitter combined forces to create speak2tweet,⁴⁰ a service that allowed users to call an international number and leave a voice message which would then be transposed into a tweet.

During the uprisings, social media in Egypt was dominated by the events unfolding. As can be seen in Figure 3.6, when surveyed retrospectively, Egyptian Facebook users believed that 85% of Facebook use at the time was in some way related to the protests.

Figure 3.6: Proportion of Facebook use for different purposes during the uprising according to Egyptian Facebook users

[Source: Dubai School of Government, 2013]



Additionally, 94% of these users got at least some of their news during the uprising from social media⁴¹ and '#jan25', in reference to the Tahrir Square protest, became one of the highest trending twitter hashtags in the region during the first quarter of 2011, with over 1.2 million mentions.

Summary

The ability of the Internet to allow its users to reach such a wide audience allows for citizen advocacy to exist at an unprecedented international level. This is generating reform across the globe, allowing Internet users to influence businesses, governments, and industry regulators. Government involvement in this trend is mixed across countries, with a broad spectrum of reactions ranging from active encouragement to shutting off the Internet at the height of protests, as shown further in Section 4. Regardless of the government acceptance, however, users have often managed to leverage the open Internet to route around any challenges in order to continue with their activities.

3.5 The Internet is Open for Business

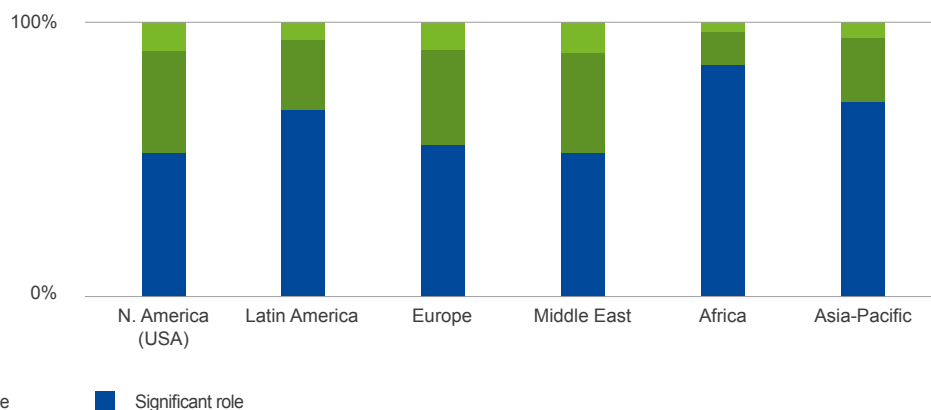
By creating a potential market of billions of users, the Internet is a natural venue to conduct business, both for traditional 'brick-and-mortar' retailers as well as new online businesses that have emerged, such as Amazon.com, which in many cases compete strongly with traditional vendors. However, the many-to-many nature of the Internet has also led to the emergence of a new segment of retailers, which are essentially online street markets that provide a platform in which anyone can sell to anyone else with low costs.

Box 5: Survey results

What type of role do you believe the Internet can play in improving the economic situation in your country for using technology to run a better business?

[Internet Society, Global Internet User Survey, 2014]

The graph shows that the Internet is believed to play an important role for business, in particular in developing regions, in recognition of the role that the Internet can play in 'leapfrogging' gaps in existing traditional offerings.

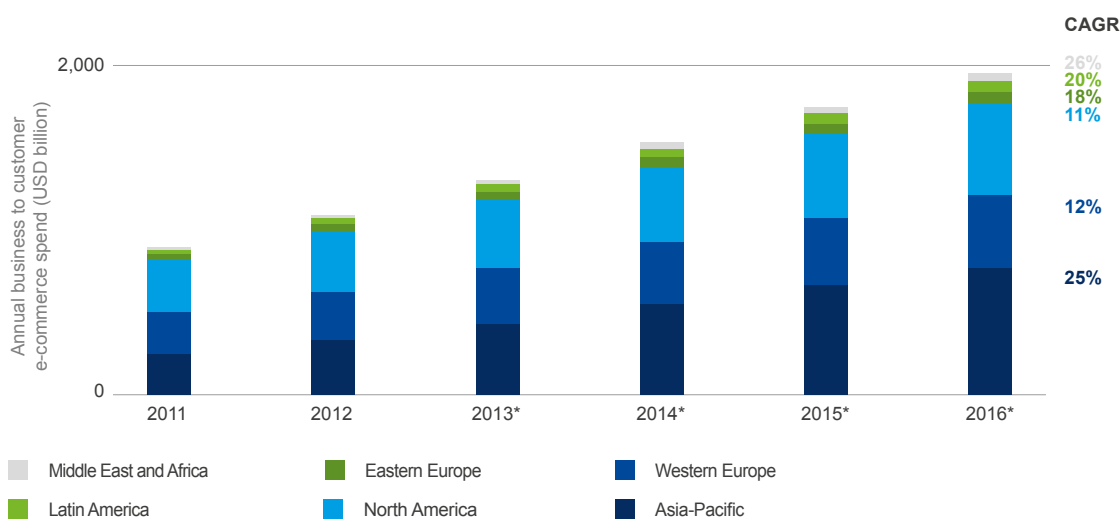


E-commerce

In general, online selling of goods and services can be categorized as e-commerce and includes sales of digital material, such as streaming media as well as physical goods. These sales can take place via auction, digital trading marketplaces, and online shops. The size of the e-commerce market is growing internationally, as shown in Figure 3.7, with growth coming from both increases in customer volumes and spending per customer.⁴² Growth is robust in all regions, including emerging markets in the Middle East and Africa.

Figure 3.7: Annual spending on e-commerce by region

[Source: eMarketer, 2013]



By leveraging the reach of the Internet, retailing has transformed from a local to a national or international affair, thereby increasing the number of potential buyers. At the same time, the Internet has lowered the cost of selling and increased the number of vendors. Etsy is a good example of a successful e-commerce marketplace, which focuses on the sale of unique handmade or vintage items.

Etsy sellers are able to immediately take advantage of the global customer base provided by the Internet, and the awareness of the Etsy marketplace within that. Not only is there an instant customer base available, but also sellers are able to launch with low up-front investment; in a survey, 35% of sellers stated their shop did not require much investment, with only 1% taking out a bank loan. As a result, Etsy hosts over 1 million 'shops' or sellers, each of whom pays a fee of USD0.20 to list each item in their personal storefront. In 2012, USD895million of merchandise was sold to customers across 200 countries.⁴⁴

E-commerce can enable trade in areas with a relatively underdeveloped retail sector. This is very much the case in

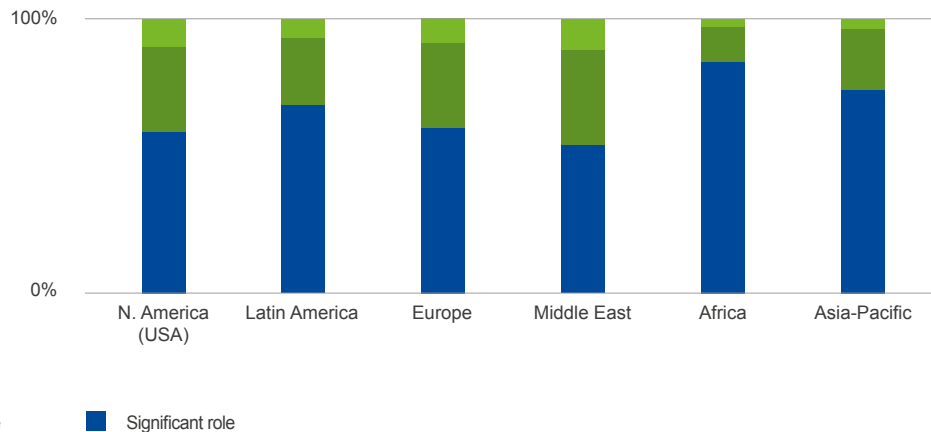
developing countries where the demand of a growing middle class can be met through online services, which can be offered with less overhead than opening traditional retail shops. Regional differences in payment systems and online access can be overcome by targeted services that adapt to the specific environment.⁴⁵

Box 6: Survey results

What type of role do you believe the Internet can play in improving the economic situation in your country for expanding the availability of goods and services on-line?

[Source: Internet Society, Global Internet User Survey, 2014]

There is clearly a positive belief in the Internet's ability to improve the economic situation in general. As indicated by the data, this belief is even stronger in developing markets, most notably Africa where more than 80% ascribe the Internet a "significant role".



The Nigerian company Jumia.com is one example of how e-commerce can create business in countries with a growing middle class. With a presence in Nigeria, Côte d'Ivoire, Egypt, Kenya, and Morocco, the company offers more than 100,000 products that can be ordered online, through SMS, phone, or agents.

Competitive effects

In addition to enabling an increase in online retailing, the Internet also allows customers to find more information about products they wish to buy than ever before, particularly with regard to prices. This increased price transparency can be delivered through customer searches or via specialized sites and smartphone apps. Such price transparency helps increase the efficiency of retail markets, and encourages retailers to price more competitively.

KAYAK,⁴⁶ launched in 2004, is one example of a price comparison service, which focuses on travel, particularly flights, hotels, and car rentals. It enables the easy comparison of hundreds of options at once, so that consumers can find the best deals available. While these deals could be found by review of each individual site, such services significantly reduce the time required, and users may find offers that would otherwise have been missed.

Of course, at the same time, the Internet is a disruptive technology, as e-commerce has a downside for traditional vendors. For instance, many products such as books, music, and video, can be sampled, ordered, and delivered online, leading to the retrenchment of retail staff or bankruptcy of large numbers of traditional retailers that were slow, or unable to respond to the challenges.

While consumers may be hesitant to purchase other items, such as clothes, without at least seeing them, a phenomenon known as 'showrooming' has emerged, whereby consumers make their choices in stores and then buy the items online, with predictable negative effects for the stores, and those suppliers that rely on the stores to attract customers.⁴⁷ Indeed, in markets where it is available, the Amazon Price Check App allows consumers to scan a product barcode in the store, determine whether Amazon offers a cheaper price, and order the product immediately.⁴⁸

The business downside of the Internet is not restricted to retailers, as it has fundamentally challenged a host of industries including entertainment, travel, and journalism, among others, while also facilitating outsourcing that has shifted jobs to lower cost countries. It is thus important, when considering the impact of entrepreneurs using the Internet to disrupt business, and the consumers who benefit from that, to take into account the traditional businesses that have been disrupted and ensure that they have the capacity to also leverage the Internet to fully compete.

Summary

The Internet opens up global markets for businesses, allowing start-up firms immediate access to a wide, international customer base directly or via an intermediary market. Additionally the Internet is encouraging innovation and promoting consumer interests by giving them access to increased information, both in terms of pricing and quality of products and services, for example with online reviews, to enable individuals to make the most well-informed decisions about spending. The downside, however, should not be ignored, as the Internet is disruptive for many traditional sectors.

3.6 The Internet is Open for Sharing

The idea of collaborative consumption is not new. For instance, hunter-gatherer societies often made use of the 'social refrigerator', wherein, following a successful hunt, tribe members shared surplus meat that would spoil in the absence of an actual refrigerator. In return, the hunter could expect meat in the future when other tribe members had a successful hunt.

Trust was implicit, as the tribes were small and members were interdependent for survival.

Today, members of modern societies acquire much more than food in their day-to-day lives: automobiles, dwellings, and money, for starters. This capital is not always used in part or fully, and capital not used is 'wasted', at least in a temporal sense. In order to capitalize on unused assets, a 'sharing economy' has arisen in which owners of capital can rent it to others when not in use, while simultaneously creating the trust mechanisms needed to protect both sides of the transaction.

If sharing was once caring, it can also be a business today. Innovative websites have enabled small-scale entrepreneurship, where private apartments become hotels, a family's mini-van turns into a taxi, and queuing an occupation. Just as the money in a bank account is lent to a borrower that pays interest, so can renting out a boat generate an income. For its owner, capital goods that were acquired for own consumption now have a productive value that can generate an income.

There are two key developments that enable this sharing economy, as highlighted in Figure 3.8.

The first can be illustrated by websites such as AirBnB, Lyft, or TaskRabbit, which are the driving forces behind the growth of the sharing economy, using their innovative solutions and ability to generate a critical mass of users. As a result of their scale and scope, a service that was once offered on the noticeboard at the local supermarket is now advertised globally through a refined system that allows strangers to do business at low costs and by facilitating the complete process of contracting – from the introduction of buyer to seller to the payment and delivery arrangements.

Second, the real innovation in the sharing economy lies with solutions to communicate trust, which is essential to transactions involving significant amounts of capital or personal interaction. Just as trust among the members in a hunter-gather society enabled the inter-temporal sharing of food through the social refrigerator, so is trust needed to rent a stranger your car or a room in your house.

Trust in the sharing economy is often communicated through a feedback system, identifying the 'good' and 'bad' users. As such, it is a crucial part of business, valued by both buyers and sellers, making the provision of trust a business idea in itself. Websites such as Fidback or TrustCloud are specifically designed to produce an online reputation that is based on information across different websites, increasing both the benefit of being trustworthy and the consequences of violating trust. In some cases, such as AirBnB, trust is enhanced through insurance that is offered on transactions.⁴⁹

1,122,257,615

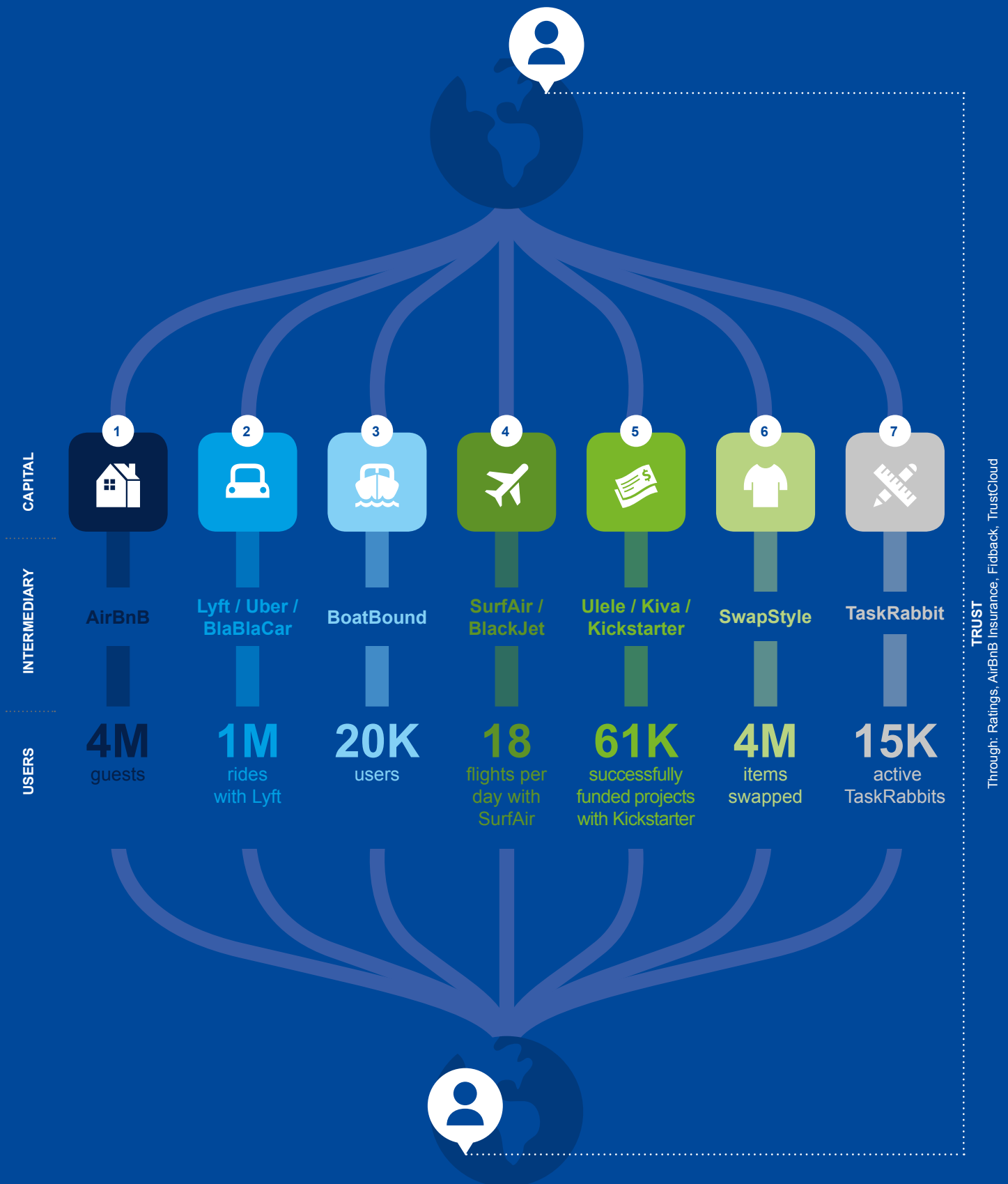
*Total US dollars pledged to
Kickstarter projects.*

20 May 2014 11:46 CET

[Source: Kickstarter]

Figure 3.8: The sharing economy

[Source: Internet Society, 2014]



Summary

The sharing economy is both something new and something old. As illustrated by history, humans have always found social arrangements to share their consumption. Whether it is the meat of a deer or the use of a car, sharing it with others optimizes consumption. The new thing is the innovative arrangements, enabled by technology, which create the trust needed to do business with strangers. If the collaborative consumption was once limited to the tribe, that tribe has now gone online and become global.

3.7 The Internet is Open for Innovation

The Internet is not only the result of innovation, it is also a significant facilitator. We have illustrated in the previous sections how the Internet can provide an entrepreneur with all the basic ingredients for innovation: education, research to gather ideas, capital for investment, and a marketplace for the results.

Without the Internet, access to the building blocks of innovation can be challenging, not least in the West African country of Togo, categorized as a so-called 'Least Developed Country' (LDC)⁵⁰ by the United Nations and ranked by the World Bank as one of the most difficult countries in which to do business.⁵¹ However, as shown by the story of the W.Afate 3D Printer, creativity can still have a chance through the hard work of dedicated individuals, facilitated by Internet access.

WoeLab is a small business incubator situated in the capital of Lomé. As a small community of creative people, sharing a common philosophy of collaborative work based on open-source technology, WoeLab represents the resourceful spirit that is the foundation of innovation around the world. This spirit is embodied in one WoeLab participant, Kodjo Afate Gnikou, the inventor of the W.Afate 3D Printer, who sees in the mountains of e-waste (see box) an opportunity for business.

Using the components often found amongst discarded electronics, Mr Gnikou began sketching a 3D printer that could be built using only e-waste. To fund the project, Mr Gnikou and WoeLab set up a fundraising campaign on the crowdfunding website Ulule in March 2013. By the middle of June, the project had already reached its fundraising goal of USD4,000.

Box 7: E-waste

The rapid developments of past decades have led to a flood of new technology and devices, which are in turn continually improved according to Moore's law and new innovations. The downside of these developments is the increase in electronic, or e-waste.

By one estimate, up to 50 million tonnes of e-waste was created last year. Some discarded items are re-used, others recycled, and a significant amount is left in landfills, often toxic due to the materials used.

The high costs of recycling have in turn led to an extensive North-South trade in e-waste, sometimes legal but often illegal, with massive landfills in the developing world as a result.⁵²

Based on an existing 3D printer design available online, the Prusa Mendel model, the W.Afate prototype is unique. At a production cost of only USD100, the 3D printer integrates e-waste gathered from old computers, printers, and scanners found in local dumping places, alongside a few new parts such as motors that had to be purchased.⁵³

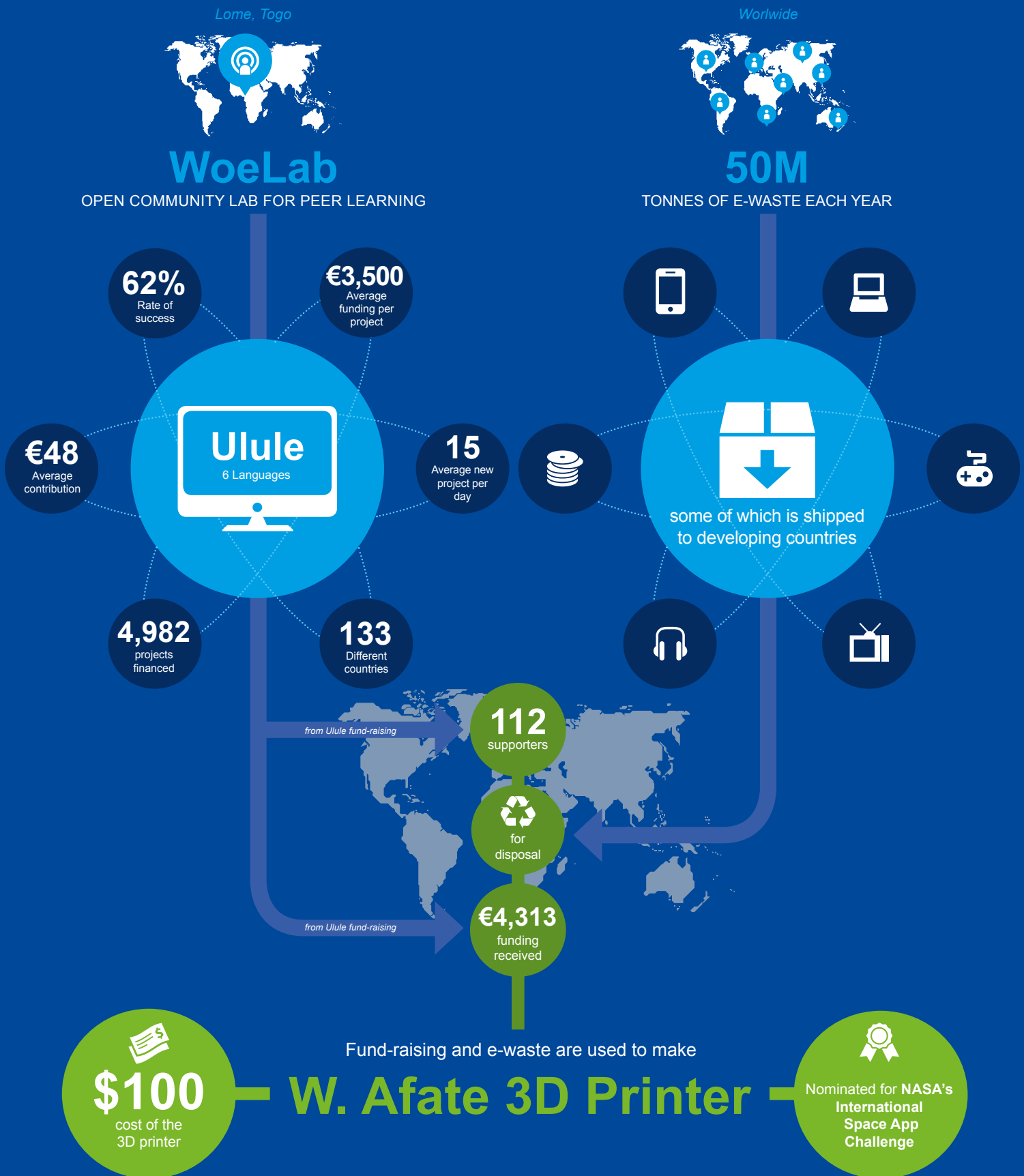
The W.Afate 3D printer is about more than the clever use of e-waste: it is about showing that all countries can be a part of the new technological revolution thanks to increasing Internet access. The fact that the W.Afate printer is part of this revolution was confirmed by the project's nomination to NASA's International Space Apps Challenge, a competition for technology that can contribute to space exploration, including a mission to Mars.⁵⁴

The crowdfunding that helped develop the 3D printer not only matches investors with inventors, it can also eliminate bottlenecks and provide a closer link between innovation and consumer demand. The Pebble watch is the perfect example of this process, in which an inventor presented an idea that spoke to a demand that major companies had not yet addressed.

The Pebble is a watch that communicates with a smartphone, enabling users to see alerts, control the phone, and use new apps that take advantage of the accessibility of the watch, such as providing times when running. It is to-date the most successful funding project at Kickstarter, raising USD10,266,845 from almost 69,000 investors who received discounts on their watches.⁵⁵ It is arguably also the most successful Kickstarter project in having launched an entirely new segment, the smartwatch, which has so far seen Samsung and Sony join the ranks, with others set to follow.

Figure 3.9: W.Afate 3D Printer

[Source: WoeLab, Ulule, The Guardian, Internet Society, 2014]

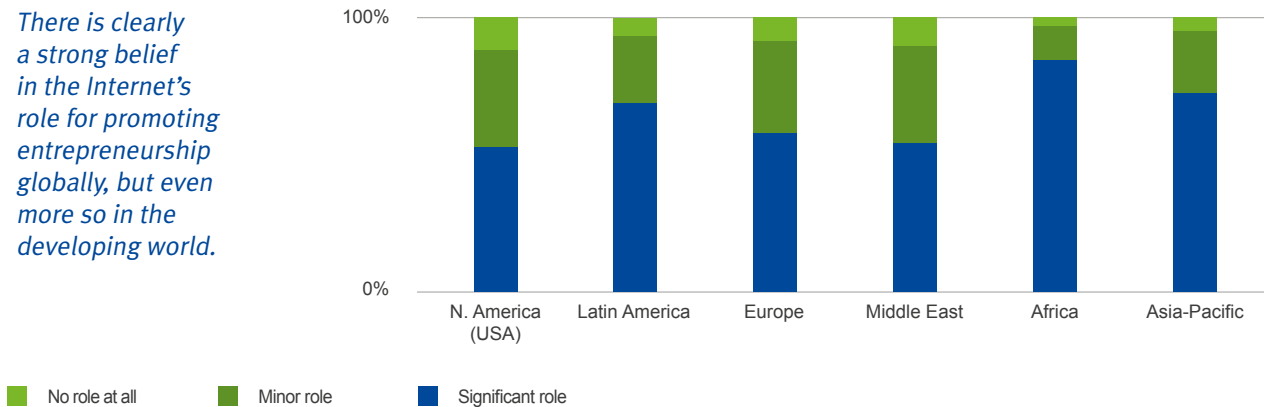


Box 8: Survey results

What type of role do you believe the Internet can play in improving the economic situation in your country for allowing entrepreneurs to conduct business through the Internet across all countries?

[Source: Internet Society, Global Internet User Survey, 2014]

There is clearly a strong belief in the Internet's role for promoting entrepreneurship globally, but even more so in the developing world.

**Summary**

Innovation does not just require inspiration, it also requires research, funding, and a sales channel. While nothing can replace a good idea, the open Internet can provide all the other ingredients needed to turn the idea into an innovation, and the innovation into income. This does not just mean that entrepreneurs such as those behind the Pebble watch can emerge to take on the largest companies in the world, but that local innovators can address local challenges and opportunities, turning e-waste in Togo into a printer that can allow others to invent and create new products and help develop a cycle of innovation.

3.8 The Internet is Open for Collaboration

The Internet is the result of a broad collaboration among its founders, and the resulting spirit of collaboration has spread to many diverse activities, facilitated by the open Internet. User contributions, from the origins of the Internet to present day, have fostered a culture of cooperation that is as vital to its continued development as any of its technical parts. Open standards and software have long represented this culture but have also inspired and contributed to collaborative projects with goals beyond the digital realm.

Collaboration continues to be the driver of developing the standards underlying the Internet. The work of organizations such as the IETF or open-source software developers behind Mozilla continuously push the digital frontier through the joint effort of dispersed individuals.⁵⁶ GitHub is a good example of efforts to promote such developments by providing a platform specifically designed to facilitate collaboration in the development of new software.⁵⁷ It is an innovation for innovations, providing a catalyst to the decentralized type of cooperation that has signified the Internet's creation and evolution.

Wikipedia, the online user-generated, free-content encyclopaedia, is a leading example of the potential for collaborative efforts to create one of the most widely visited websites around the world. There were, as of March 2014, 287 different versions of Wikipedia, separated by language. These vary in size from the original English language Wikipedia, with over 32 million total pages, to the Herero⁵⁸ language with just 118 pages.⁵⁹ Visitor numbers are growing globally, with 530 million unique visitors in October 2013 up from 277 million in October 2008.⁶⁰ At the same time, as of April 2014, users had made over 2.3 billion edits to existing and new pages.⁶¹

Collaboration extends well beyond the development of the Internet. Fold.it is an example of an innovative form of collaboration for scientific research that has been enabled by the Internet.⁶² By making use of the so-called gamification technique, individual users are engaged in protein folding simulations to help fight diseases. By playing what appears to be a three-dimensional puzzle, the player is actually helping science to understand how different protein structures fold into their functional shapes. This innovative way of using volunteers' creativity has not only resulted in important contributions to the study of protein folding, but also to a broader field of science by collecting data on humans' pattern-recognition, which could be used to teach human strategies to computers.

Summary

The Internet is the result of open collaboration, as well as a facilitator of collaboration across fields. As a platform for instant communication with a global reach, it can facilitate cooperation with participation from all corners of the world. The result is not only innovative applications of existing technology, but also the development of new ones.

3.9 The Internet is Open for Fun

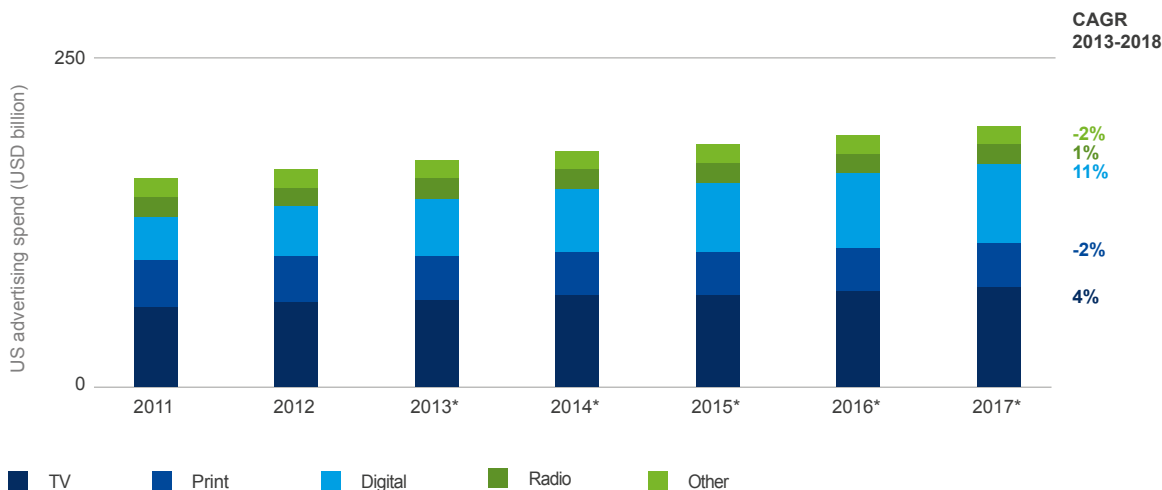
The Internet is rapidly becoming a primary destination for accessing media, due to the availability of huge volumes of users and low cost of delivery. This includes written media, in the form of news websites or blogs, music, or video content, all of which can be digitized, delivered, and consumed over the Internet.

The many-to-many nature of Internet communication has also facilitated the rapid development of a multitude of social media platforms, such as Facebook and Twitter, which are making it easier than ever for users to keep in touch.⁶³

An indicator of the value that media consumers receive from the content and services available online is provided by the shift in the proportion of advertising expenditure from traditional forms of media to online (digital) media. As shown in Figure 3.10 below, spending on advertising in the USA is forecast to rise particularly rapidly in digital media, websites, and mobile apps, increasing from 22% of total spend in 2012 to 31% by 2017.⁶⁴

Figure 3.10: USA advertising spend by medium

[Source: eMarketer, 2013]



Social media

Social media platforms have made it easy to reach many more people than more traditional media formats, which are often constrained by national borders. For example, the newspaper with the highest circulation in the world, Yomiuri Shimbun, has 10 million readers;⁶⁵ Barack Obama, with his 40.6 million Twitter followers, can reach more people with a single tweet than this, or any other, newspaper.

While social media, as mentioned above and discussed in Section 3.3, can be used by citizens to interact with governments, or by businesses with customers, its dominant use is for entertainment. This can be seen by considering the top Twitter accounts, as shown in Figure 3.11 below. Seven of the top ten accounts (by number of followers) are for musicians, while a further two are for entertainment-related services, YouTube, and Instagram. President Obama is the only politician in the top ten.

Figure 3.11: Top twitter accounts, 20 December 2013

[Source: fanpagelist.com, 2013]

Account	Category	Twitter followers (million)	Facebook fans (million)
Katy Perry	Musician	48.6	61.0
Justin Bieber	Musician	47.8	60.5
Lady Gaga	Musician	40.9	61.2
Barack Obama	Politician	40.6	37.8
Taylor Swift	Musician	37.7	51.6
YouTube	Product	37.4	77.3
Britney Spears	Musician	34.8	34.1
Rihanna	Musician	33.3	81.5
Instagram	Product	29.8	7.1
Justin Timberlake	Musician	29.3	29.4

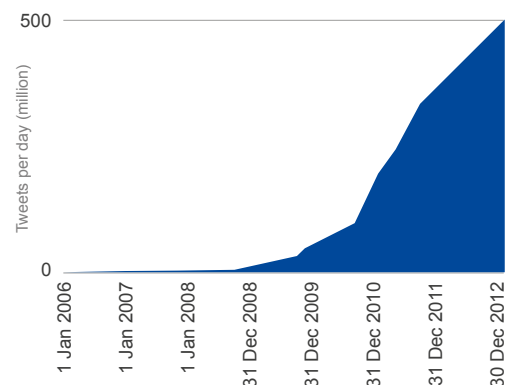
Likewise, of the top 20 Facebook fan pages on 20 December 2013, seven are musicians, two actors, and one an athlete. The remainder are brands, films, TV shows, and games.

The use of social media sites is vast, with 6,282 tweets, 786 Instagram photo uploads, and 1,109 Tumblr posts every second on one recent day, 20 December 2013.⁶⁶ Twitter’s use has grown dramatically since its March 2006 launch, as shown in Figure 3.12, with over 500 million tweets now sent every day by over 230 million active users. The service is truly global, operating in 35 languages, with 77% of accounts originating from outside of its home market, the USA.⁶⁷

Recent trends reveal that emerging regional or local social media platforms are able to compete with the largest global ones, namely Facebook (with 1.15 billion monthly active users) and Twitter (with 240 million monthly active users). Examples of emerging platforms include WeChat from China (with 236 million monthly active users), and vkontakte from Russia (with 31 million monthly average users).⁶⁸

Figure 3.12: Tweets per day

[Source: internetlivestats.com, 2013]



The Internet also hosts other entertainment forms, including gaming, music, and online video services.

Online gaming

By November 2013, the gaming market in the USA, including downloadable, social, mobile, and MMO (massively multiplayer online) games was valued at USD11.8 billion.⁶⁹ This strong performance of the gaming market is not exclusive to the USA, with the Brazilian Internet gaming market expected to be valued at USD1.4 billion for 2013, up from USD72 million in 2008.⁷⁰

Angry Birds is an instructive example of a game designed for mobile use that has seen huge levels of success, with over 1.7billion downloads by November 2013⁷¹ generating over USD199 million in revenues during 2012.⁷² The game was originally released on the Apple App Store in December 2009 and has since built on its addictive nature and low price to generate a following that has allowed it to develop games for other mobile devices, video game consoles, and PCs. A full-length feature film based on the game is in development and expected to be released in 2016.

Multi-player games are also very popular, using the Internet to connect players online. Having launched in November 2004 and peaked at approximately 12 million subscribers in 2010, World of Warcraft remains the most popular MMO.⁷³ The game is funded on the basis of a paid subscription, with expansion packs available to buy. The game has developed a virtual economy, with items such as virtual gold and services available for sale. The most expensive World of Warcraft transaction publicized to date is the September 2007 purchase of an account, based on a particularly well-equipped character, for USD9900.⁷⁴

Online music

Accessing music via the Internet is becoming increasingly popular, with growth in spending on online distributed music growing at a rate such that, in 2012, the overall value of the recorded music market grew (by 0.3%) for the first time since 1998.⁷⁵ This value has arisen from using the Internet for both streaming and downloading of music.

Internet radio services such as Pandora, available in the USA, Australia, and New Zealand, provide an interactive service by recommending music to users based on their tastes, selected artists, and feedback on earlier suggestions. This service is available free of charge, funded by advertising, or on a subscription basis with the advertising removed. As of April 2014, Pandora had 76 million active users, who listened to 1.70 billion hours in that month.

143,199

Record number of tweets per second, during an airing of the classic anime film "Castle in the Sky" in Japan.

3 August 2013, 23:21:50 JST

4,500,000,000

Hours of Spotify streamed in 2013

[Source: Spotify]

The Internet also enables digital downloads of music via stores such as iTunes, Apple Inc.'s online media library service. This allows users from approximately 115 countries spread across all regions⁷⁶ to download and organize digital video and audio content on PCs, laptops, and Apple devices. The third-party content in the library is available to purchase or to rent from the iTunes store. The service offered is very popular: in February 2013, Apple announced that over 25 billion songs had been purchased from the iTunes store.⁷⁷

Online video

The range of video content available on the Internet is vast, ranging from the seven-second user-generated Vine clips to short YouTube videos and full-length TV and film content available through downloading and subscription services such as iTunes and Netflix. Since its 2012 founding, Vine has been used for everything from journalism to advertising – showing the scope of Internet video, even within the confines of such a short video clip – however, its major use has been for entertainment purposes. Similarly, YouTube's top trending videos for 2013 included parody music, such as Ylvis' 'The Fox', with close to 320 million views, and a promotional prank for the film *Carrie*, the 'Telekinetic Coffee Shop Surprise'.⁷⁸

Uptake of Netflix's online streaming service is significant in the USA, where by the end of 2013 it had 33.42 million members.⁷⁹ As can be seen in Section 1 above, Netflix-related traffic constitutes a significant portion of aggregate traffic in the USA, particularly over fixed access networks. Netflix is replicating this success in its new markets, with services available in 41 countries with almost 11 million international members.⁸⁰ Netflix is now extending into developing its own content⁸¹ and continuing to sign deals for content from major studios.⁸²

Summary

The Internet has acted as a new channel for the distribution of entertainment, as well as enabling new, more interactive and personalized media. The open Internet has enabled consumers to generate their own videos, articles, and music, and share them with a truly global audience.

3.10 Conclusion

The open Internet, by connecting nearly 3 billion users in one network, has had a significant impact on a number of traditional services that were traditionally delivered on a 'one-to-one' or 'one-to-many' basis. In addition, however, it has led to entirely

1,992,738,923

Views of the "Gangnam Style" official music video, by South Korean singer PSY.

20 May 2014 13:45 CET

[Source: YouTube]

new services and applications by enabling 'many-to-many' interactions, as well as interactions between smaller groups for a host of issues.

With respect to more traditional services, the Internet has had an almost revolutionary impact by lowering the cost of delivering and receiving information, eliminating borders so that any service can reach a broader audience, and allowed for interaction where services were formerly one-way. This has affected education, with the rise of MOOCs; allowed international distribution of entertainment and e-commerce; enabled governments to deliver online services, while receiving citizen feedback in the form petitions; and empowered online advocacy.

At the same time, new forms of interaction have been established. Social media enables family, friends, colleagues, and fans to be connected, and send and receive updates, announcements, and messages. The sharing economy has arisen to allow consumers to make their time or possessions available to others for money or barter. Innovators can now research ideas, borrow money from others, and sell their goods online. And finally, volunteers can build on the ethos that led to the Internet itself to collaborate on new software, create a new online encyclopaedia, and cure diseases.

These new modes of interaction based on the Internet have economic and social benefits that are significant, growing, and almost limitless. In the next section, we discuss some of the existing challenges to the open Internet and some that are emerging, resulting in a different Internet experience within and between countries, which should be addressed to protect the open Internet and promote its spread so all can realize the benefits described here.



SECTION 04

Challenges to the Open and Sustainable Internet

4.1 Introduction

The benefits of the open Internet flow from the development and adoption of a set of underlying protocols that are in use worldwide. These protocols help to create the base of nearly 3 billion users, allowing them to communicate with one another to generate the benefits described in the previous section. However, while the Internet is often called the 'network of networks', all networks are not created alike.

Creating a global network of networks based on a standard platform is a foundational success of the Internet. To highlight both the benefits of the common platform and where Internet networks and services fall short of delivering a uniform user experience, we consider first what is basic to the Internet experience across countries, and then the differences.

First, the IP platform represents a truly unique global standard. By way of contrast, a maze of standards are involved in the experience of getting online, illustrating the difficulty of achieving a global standard. With respect to the computer, there are different operating systems, different keyboards,¹ and even significant differences in electricity standards needed to power the computer.² Likewise, as a legacy of differentiated telecommunications networks, there are a variety of access standards for fixed and mobile broadband access.³

Once the user has the device charged and ready to go, however, the Internet is an oasis of standardisation. Regardless of the type of fixed access, the Ethernet connection used to connect the device to the Internet is the same everywhere. Likewise, the same Wi-Fi standards can be used to connect all over the world and, once online, the same applications, such as email and browsers, will work without any sort of adaptation or conversion.



1,215,936

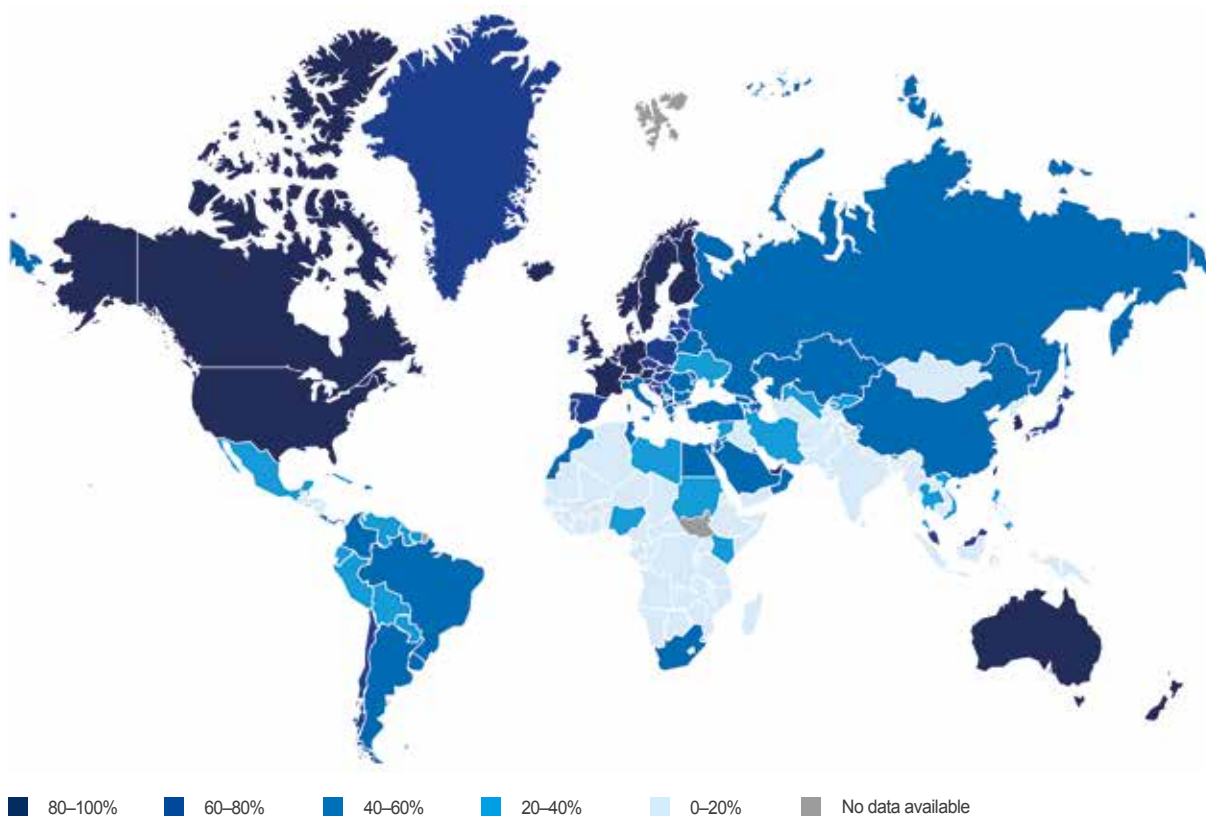
Apps available in Google Play
19 May 2014

[Source: AppBrain]

That is not to say, however, that there are not significant differences between countries in terms of Internet access and usage. The first, highlighted in Figure 4.1, relates to the penetration of Internet users between countries. The more users within a country and in neighboring countries, the more benefits to any other user in being online.

Figure 4.1: Illustration of global Internet penetration levels in 2012

[Source: ITU, 2013]



Further, for those users already online, the overall user experience can differ significantly by country. Any such differences, however, do not originate from technical standards, but rather from government policy and economic reality. In particular, these differences can arise at two layers of the Internet:

- Infrastructure. Countries can differ by the affordability and bandwidth of access networks, and by the resilience of their international connections to other countries, based on economic factors and policy and regulatory choices.
- Content and applications. Some governments require network operators to filter content or block applications, using political or legal justifications. In other cases, content may not be available or locally relevant for economic reasons.

In summary, while the open Internet is an unparalleled positive force for advancement, it is not immune from economic and political influences that act to limit benefits. An affordable and reliable Internet is not yet a reality for the majority of people in the world. At the same time, where access is available it should not be taken for granted. The mere fact of being connected does not guarantee one will be able to innovate or freely share information and ideas; these abilities require an enabling Internet environment, one that is based on unrestricted openness.

The best antidote to challenges to openness is a multi-stakeholder model for technical, policy, and development solutions as described in Section 2. This must apply both within and among countries, to ensure that all voices are heard and the benefits of the open Internet are maximized. This is particularly relevant as the aftershocks of the recent revelations regarding global online surveillance are absorbed and adapted to by governments, companies, and users.

4.2 Infrastructure

Access to the Internet is necessary, but not sufficient, to fully participate in the global information society. Access can be provided via mobile or fixed technologies, which are increasingly of the broadband variety in order to let users take advantage of faster speeds and ‘always-on’ service. The access networks connect to the Internet via domestic and international connectivity, increasingly based on fibre-optic networks that provide both the high speeds and the capacity needed to accommodate all types of traffic.

Access may not be available to all citizens because of the high costs of network deployment or low-income levels of intended users, rendering the services unaffordable. The resulting digital divide separates users within a country, based on a region or income levels. However, the digital divide also separates countries, with more advanced economies forging ahead with fixed fibre broadband networks and the latest 4G mobile networks, leaving behind other countries with older fixed networks and earlier generations of mobile access networks.

Finally, access is contingent on the resilience of all parts of the network, including in the face of natural disasters, technical mishaps, or acts of government. The fewer the number and redundancy of connections, such as the number of submarine cables connecting a country, the more susceptible the

country is to an accidental cable cut. Likewise, as we have seen more often in recent times, governments' efforts to shut down the Internet in the face of protests are more successful in circumstances where the network is less resilient.

We now examine how the user experience across countries differs based on differences in access as well as events that restrict access such as cable cuts or government actions.

Digital divide

A digital divide exists globally, with different levels of access to Internet services available in different geographies. This digital divide has arisen in part due to disparities arising in the cost of devices, software, and infrastructure around the world, particularly relative to the economic status of countries and hence the 'affordability' of Internet services. With a typical Internet subscription making up anywhere between 0.1% of monthly average GDP per capita in Austria to 294.8% in Kiribati, there is a broad range in the affordability of Internet services.⁴

As can be seen in Figure 4.2, affordability is distributed on a regional basis, with the majority of North American, developed Asia-Pacific and European countries having access to Internet services at a value of less than 2.5% of their monthly average GDP per capita. However, in South America, Africa, the Middle East and Asia-Pacific, there are many examples of countries in which an Internet access subscription makes up over 10% of the average GDP per capita. These countries are often those in which both service costs are relatively high and GDP per capita levels are relatively low.⁵

The UN Broadband Commission has targeted entry-level broadband services being made available at less than 5% of average monthly income by the end of 2015.⁶ While the overall majority of countries measured for 2012 have reached this target, the majority of developing countries have not yet.⁷

The cost, or more precisely affordability, of Internet access has a significant impact on the uptake of services. This relationship between affordability and Internet usage is illustrated in more detail in Figure 4.3 below.

Figure 4.2: Proportion of average GDP per capita required for broadband access in 2012

[Source: ITU; World Bank, 2013]

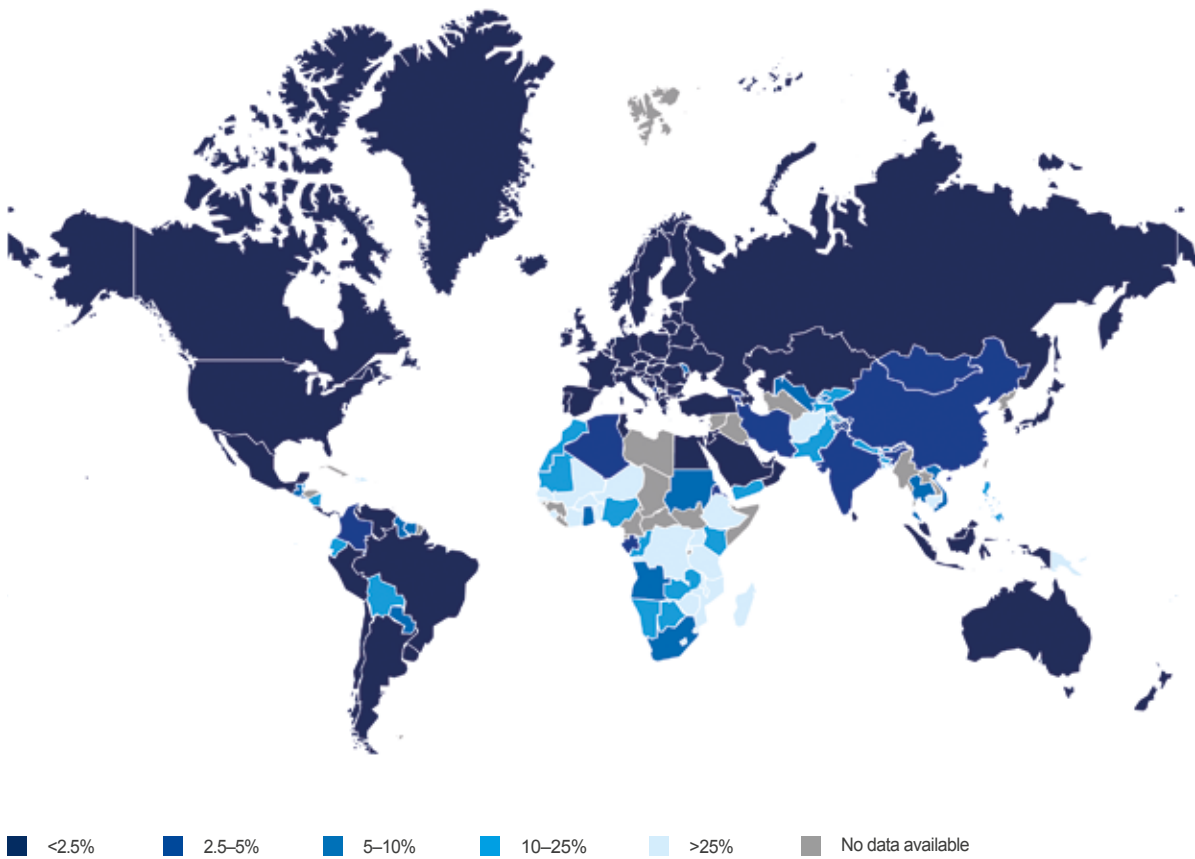
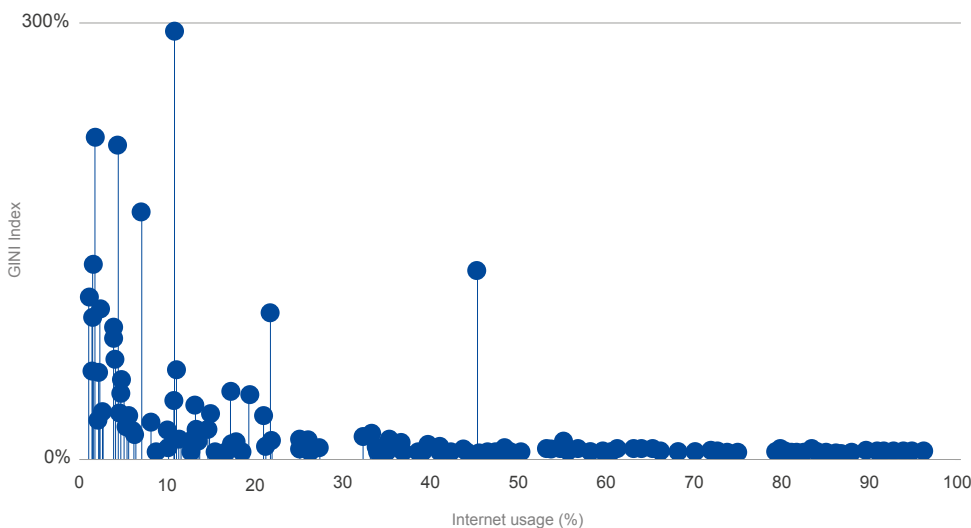


Figure 4.3: Relationship between proportion of GDP per capita for broadband access and Internet usage proportion in a country

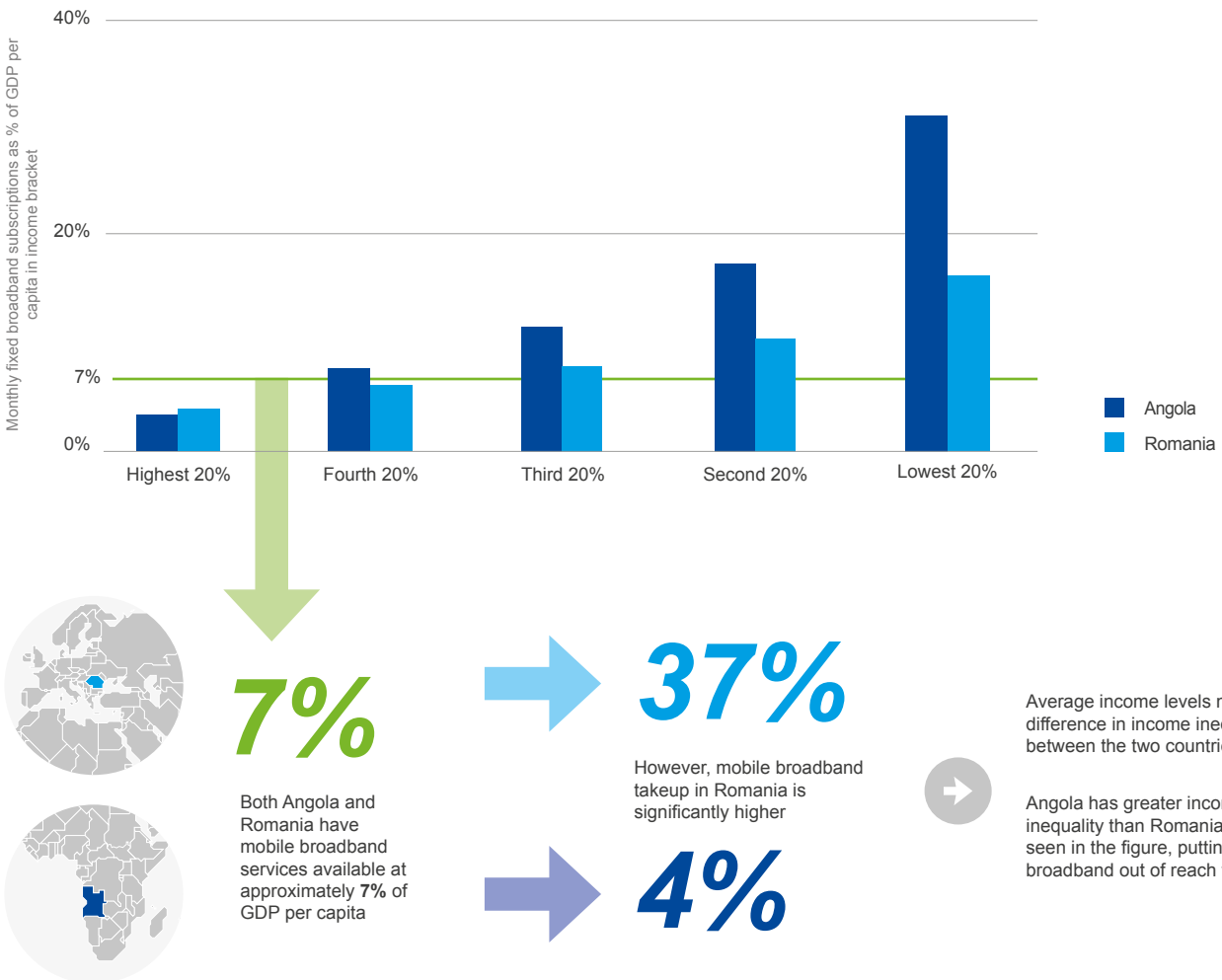
[Source: ITU; World Bank, 2013]



Internet adoption is not only influenced by the average income in a country, but also by the distribution of income within the country. By way of illustration, if a billionaire walks into a room, he/she will raise the average income in the room significantly, but that would not increase the buying power of anyone else in the room, for broadband or any other purchase. Thus, a high average income does not necessarily translate into higher affordability, if it results from significant inequality, as illustrated in Figure 4.4.

Figure 4.4: Analysis of the use of GDP per capita in computing affordability

[Source: Analysys Mason, ITU, World Bank, 2013]



In addition to affordability, countries and regions are divided by significant infrastructure differences, even where access is readily available. One measure is download speed for broadband Internet access,⁸ as shown in Figure 4.5. The higher the bandwidth, the more users can access advanced services, particularly ones that rely heavily on video. The median download throughput achieved is governed by the quality of the country's infrastructure and hence the level of investment in telecommunications. It is, therefore, generally the wealthier countries in which the higher broadband speeds are available.

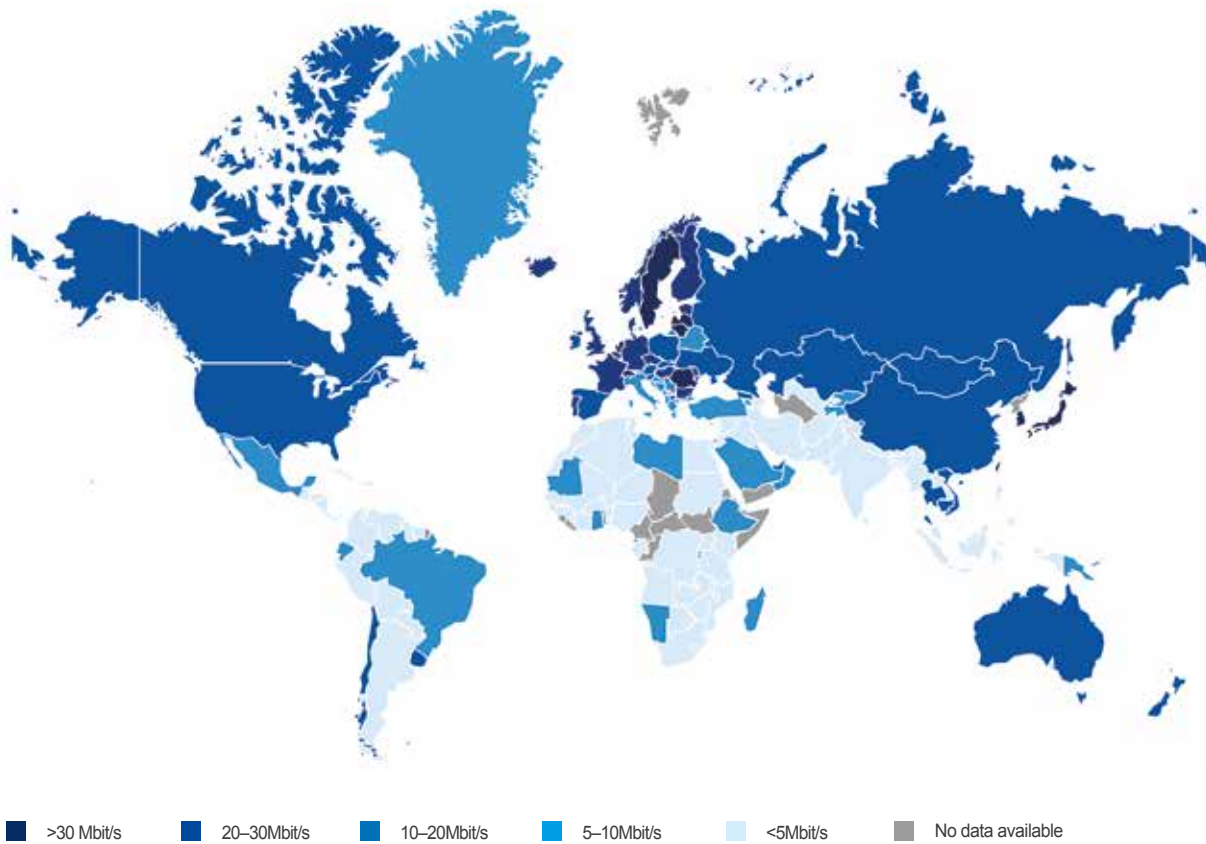
Of interest is that some of the larger countries underperform with regard to throughput when compared to how they score for affordability. For instance, compare Belgium and Australia, both countries in which less than 2.5% of average GDP per capita was required for broadband access in 2012. However, while 97.1% of Belgium homes had access to broadband speeds of over 30Mbit/s in 2012,⁹ only 14% of Australian Internet subscribers received services with speeds of over 24Mbit/s in June 2013.¹⁰ One significant difference between the countries is that Belgium has a population density of 364.84 per square mile, while it is just 2.91 in Australia,¹¹ significantly increasing the cost of rolling out an advanced broadband network in Australia. In order to overcome these challenges and increase download speeds across the country, the Australian government is proposing to invest AUD29.5 billion (USD26.1 billion) in the building of a fibre national broadband network.¹²

The digital divide has arisen due to a number of reasons, including differences in wealth between countries, differences in population density and other infrastructural challenges, and possibly differences in telecommunications policies and regulations. Efforts to remove barriers to connectivity and to promote infrastructure will help to both lower the cost of access and increase the quality of services offered.¹³ For instance, efforts to promote the deployment of IXPs, as described in Section 2, help to lower the cost of traffic delivery while also reducing latency.¹⁴

The increasing affordability of the Internet across all nations will result in a narrowing of the digital divide between nations in terms of access, although regional disparities will remain. As less economically developed countries gain access to the open Internet on a wider level, users within their borders will obtain greater access to the benefits of the Internet, promoting innovation and the free sharing of information and ideas.

Figure 4.5: Median download speed for fixed Internet access across 2013 and 2014

[Source: NetIndex, 2014]

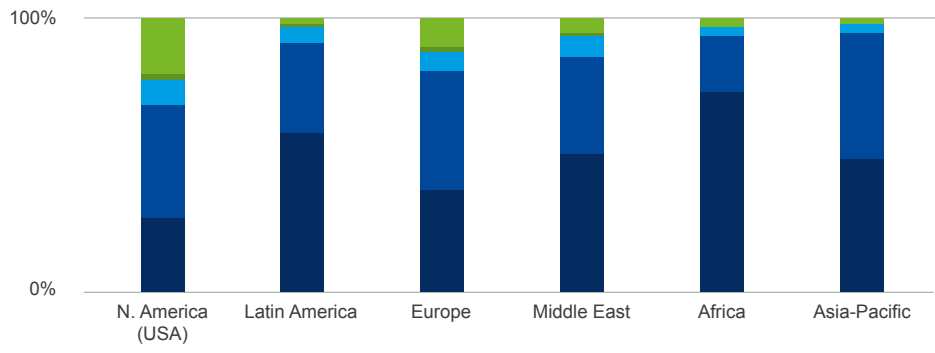


Box 9: Survey Results

Before the Internet reaches its full potential in your country improvements need to be made in the local physical infrastructure

[Source: Internet Society, Global Internet User Survey, 2014]

Our survey results indicate that respondents in Africa and Latin America, in particular, are most likely to 'strongly agree' with the notion that physical infrastructure needs to improve to allow the Internet to reach full potential, while that number is the lowest in the USA



Legend for Box 9:

- Don't know / Not applicable
- Strongly disagree
- Somewhat disagree
- Somewhat agree
- Strongly agree

Resilience and disruptions

Users in some countries may not just suffer from high costs or slow access speeds, but also from disruptions that may make the Internet inaccessible for a period of time. In addition to preventing user access to content and applications, this may inhibit investments in online services that require reliable Internet access. In this section, we examine general resilience of the network, as well as incidences of specific disruptions in 2013.

Internet resilience denotes the risk of large-scale Internet disruptions, with those countries with low resilience having a high risk of disruptions. Resilience is impacted by the diversity of interconnections between national infrastructure and international data carriers. Where there are more international connections in place, it takes a greater amount of damage, infrastructure attacks, or government intervention to shut down access to the global Internet in the country.

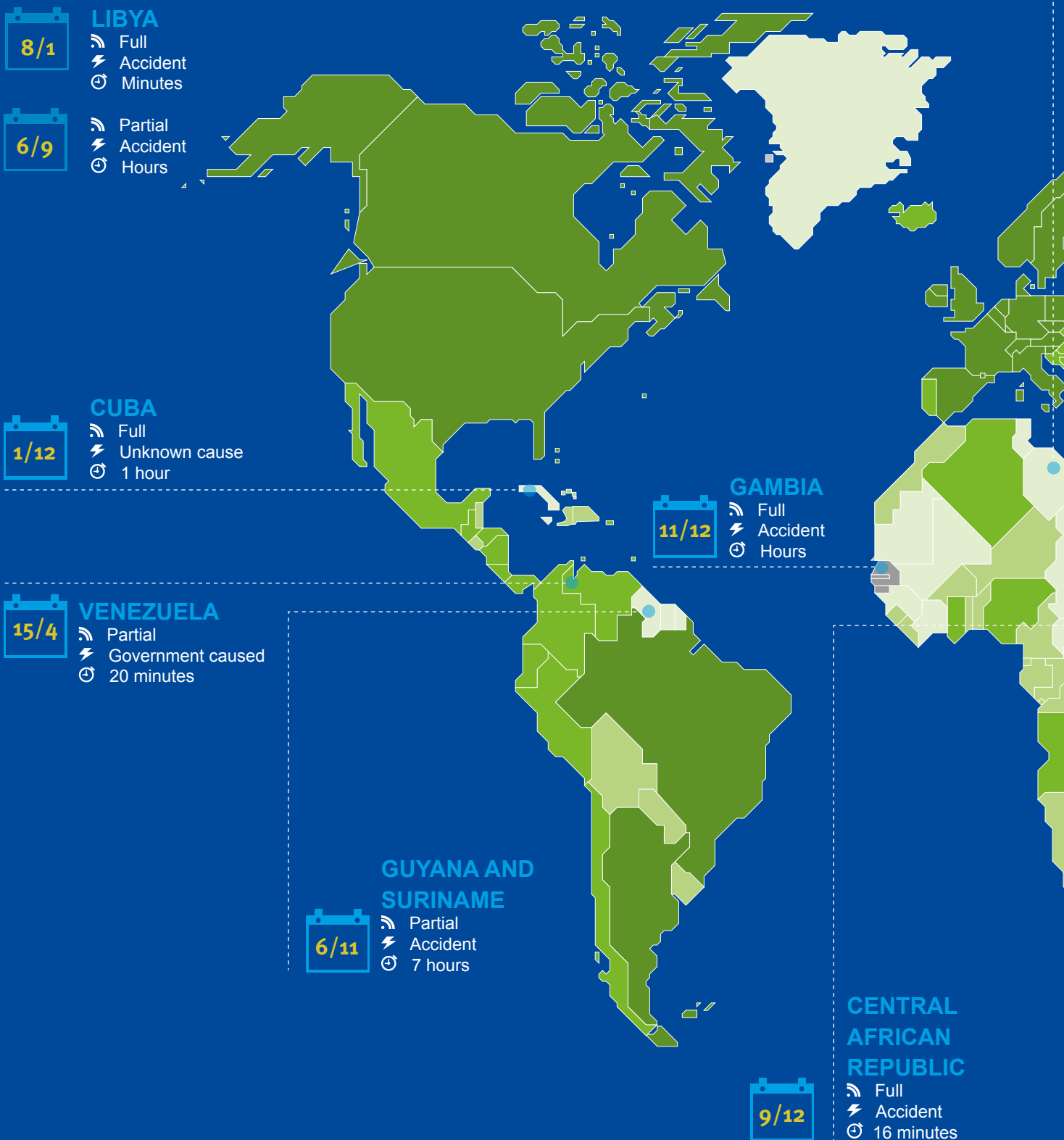
As an example of the risk of low resilience, in 2011 an elderly woman in Georgia inadvertently severed the main terrestrial fibre cable link to Armenia, cutting off the Internet in the latter country for up to five hours.¹⁵ Undersea, a recent cut in the SEA-ME-WE 4 cable near Alexandria, Egypt, resulted in a significant slowdown of the Internet in Africa, the Middle East, and parts of Asia. In this case, there are multiple cables providing resilience, but several were being maintained, and thus could not provide diversity when needed.¹⁶

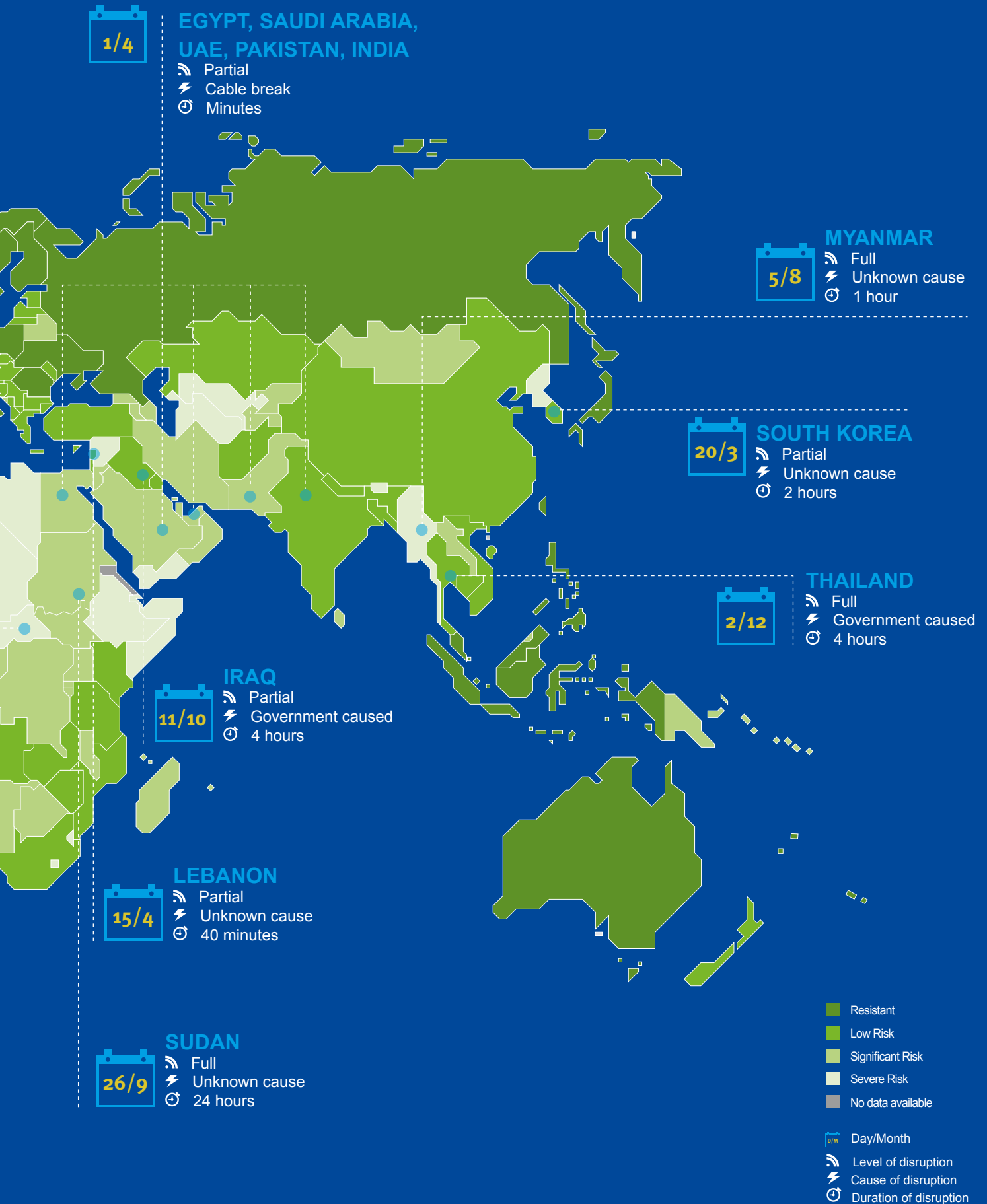
The history of government-led shutdowns extends back to 2007, when such a shutdown was used in response to Burma's Saffron Revolution.¹⁷ In countries in which Internet access is controlled by a government-owned monopoly, such as in Syria, it is relatively simple for the government to switch off access to the Internet unilaterally – there is no diversity and the government has control over the provider.¹⁸ On the other hand, in Egypt, where there are a number of ISPs, the government was still able to shut down the Internet, in part based on the control of Egypt Telecom, the majority government-owned incumbent, over the fibre-optic cables.¹⁹

Renesys, which gathers Internet intelligence to help organizations improve the reliability of their Internet usage, has scored the resilience of countries based on the number of direct connections between domestic and international Internet providers visible on a global Internet routing table.²⁰ Its research shows that the majority of Internet disruptions reported in 2013 occurred in countries considered to be at severe or *significant risk* (see Figures 4.6 and 4.7).

Figure 4.6: Illustration of the correlation between Internet resilience and Internet disruption in 2013

[Source: Renesys, Analysys Mason, 2014]





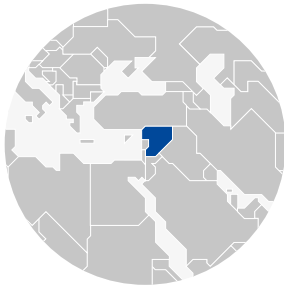
The consequences of Internet disruptions include the loss of or reduction in the ability of the population to engage in economic activity, reach emergency services, and connect with loved ones. The only short-run resolution to be found is for the disruption to be lifted, either by repairing the damaged routes, lifting the regulatory block, or finding an alternative route by which to transmit the data. In the longer run, resilience must be built into the system with a greater diversity of international connections.

Figure 4.7: Case studies of disruptions to Internet connectivity

[Source: Analysys Mason, Huffington Post, 2013]

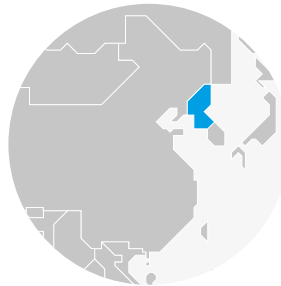
 Day/Month

SYRIA

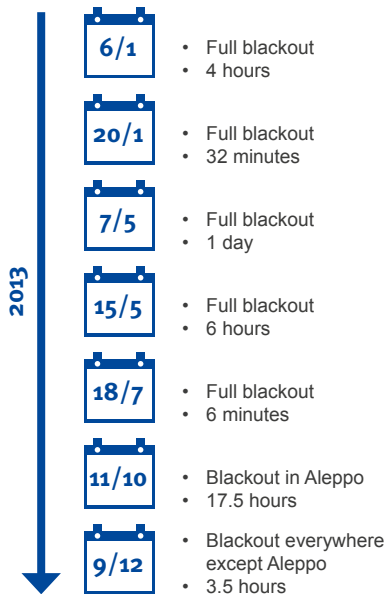


7 Internet blackouts have been reported in Syria during 2013, with durations lasting between 6 minutes and one day

NORTH KOREA

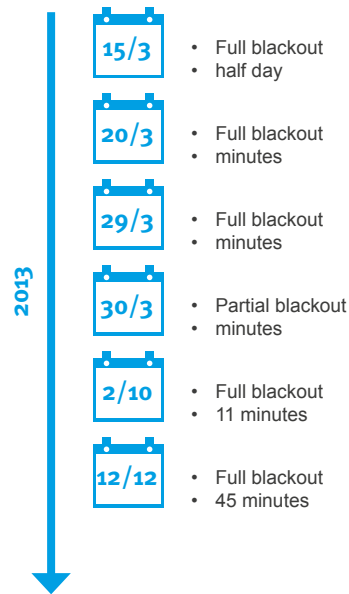


North Korea has also experienced a number of Internet outages in 2013, many in March, with the majority of these lasting less than an hour



The reason for these disruptions is unknown; however, it is likely they are linked to the civil war taking place in the country

Some commentators have suggested they could be the results of purposeful government action



There has been no confirmed cause of these disruptions. The North Korean government has accused the USA and its allies of carrying out cyber attacks

However, it seems more likely that these outages are the result of technical issues from within the country, such as power failure, equipment failure or a misconfiguration by a network admin

Deliberate government-initiated shutdowns are a breach of the UN's guiding principles on freedoms of opinion and expression. Article 19 from the International Covenant on Civil and Political Rights states with regard to the Internet that "States parties should take all necessary steps to foster the independence of these new media and to ensure access of individuals thereto"²¹, and that:

It is also inconsistent with paragraph 3²² to prohibit a site or an information dissemination system from publishing material solely on the basis that it may be critical of the government or the political social system espoused by the government.²³

Any such block of the Internet constitutes an intrusion into the basic rights of its citizens to communication and could in the long run have a detrimental impact on the economy and society of a country.

The Internet was designed to route around damage to the network, and this extends to efforts to block use of the Internet itself. Users of the Internet have been responsible for developing innovative methods to work around government blocks, particularly when these have occurred in times of civil unrest. The 26 September 2013 Internet shutdown in Sudan occurred on "Martyrs' Friday", a day promoted on social media as a time to protest in the country in remembrance of those who had died in previous protests. Activists responded to this shutdown by launching the Abena Crowd map,²⁴ which tracked demonstrations using SMS-based reports. While the Internet shutdown prevented those in Sudan from seeing the map, it gave those in the rest of the world an insight into the activities in the country beyond those reported by the government-censored media. Additionally, Twitter's Speak2Tweet service, launched during the 2011 Egyptian Internet shutdowns (as discussed in Section 3), was restarted as a way to sidestep the Syrian Internet shutdowns.²⁵

Internet resilience can be improved through investment in infrastructure or removal of regulatory barriers prohibiting or discouraging new international connections. Such increases in Internet diversity may occur without intervention, as a result of economic growth making it profitable for new Internet providers to enter the market. Alternatively, local regulators can promote investment and new entrants, helping to overcome the monopoly advantage experienced by some strong incumbents in less developed markets.

An example of an international venture to increase connectivity and, therefore, resilience is the West Africa Cable System (WACS), a 14,000km submarine cable owned by a consortium of 12 operators and regulators. The cable was completed in late 2011 at a cost of USD600 million, with 14 landing sites across Western Africa and Europe. Five of these landing sites – those in Angola, Namibia, the DRC, the Republic of Congo, and Togo – were the first submarine cable landing sites in each country.²⁶

Similarly, increases in the diversity of providers can result in improvements in resilience. For instance, the WACS cable was developed under an open access policy, allowing ISPs to access international capacity without having made the upfront investment.²⁷ Likewise, increasing the number of broadband providers in the country also increases diversity and resilience. In Costa Rica, for example, the June 2009 General Telecommunications law ended the monopoly of Kolbi, the telecoms division of the government-owned utility company Grupo ICE. Today there appear to be at least six broadband providers in the country.²⁸

In general, according to the latest ITU annual regulatory survey for 2012, 93% of countries responding had competition in Internet services, and 85% had competition at international gateways.²⁹ This represents a significant increase over recent years, but nevertheless a number of countries still lack competitive diversity in these key services. Further, having allowed competition, not all competitors may enter with their own facilities, and thus competitive diversity may not result in route diversity.

Although Internet resilience is high in the majority of countries, many countries still experience Internet disruptions for a variety of reasons. Greater levels of infrastructure investment and action to circumvent government-initiated shutdowns may help to reduce the frequency of all forms of disruption in the future. This ensures a more stable Internet experience for users, and also helps to promote investment and availability of content and applications.

4.3 Content and applications

Internet infrastructure is a means to an end – accessing the vast amount of content and applications that are available on the Internet. In addition to the differences in

access conditions detailed in the previous section, content and application availability can differ significantly between countries based on government actions to restrict access or business decisions on availability.

Much more common than cutting off the entire Internet – an approach typically used in the short-term during a period of unrest – governments may choose to restrict access to specific content or applications over the long-term, for political or social reasons. Similarly, businesses may choose not to make content available for particular uses or in all countries based on copyright licensing decisions. At the same time, even content not subject to such restrictions may be realistically unavailable in countries with little or no content hosted locally – the international links needed to access content may add latency and cost that effectively restricts access.

Filtering and blocking

Governments can enact laws and measures that enable them to restrict access to content that they deem to be undesirable, which they extend to online content. The majority of such measures are associated with blocking content relating to pornography, gambling, and hate speech, in line with religious or social norms in the country. However, a number of countries are more interventionist, blocking social and news content, often in a politically motivated manner.

Freedom House, an NGO focused on promoting political freedom, published a report in October 2013 entitled *Freedom on the Net*.³⁰ This report analyses Internet freedom across 60 countries, focusing on developments between May 2012 and April 2013. Each of these countries was scored out of 35 for 'Limits on Content', with scores ranging from lows of 1 in Iceland and the USA to 32 in Iran.³¹ As can be seen in Figure 4.8, countries with particularly high levels of limitation on content imposed by their government (scores greater than 20) appear to be concentrated in the Asia–Pacific region and in Africa, although we note that no data was available for a large number of countries.

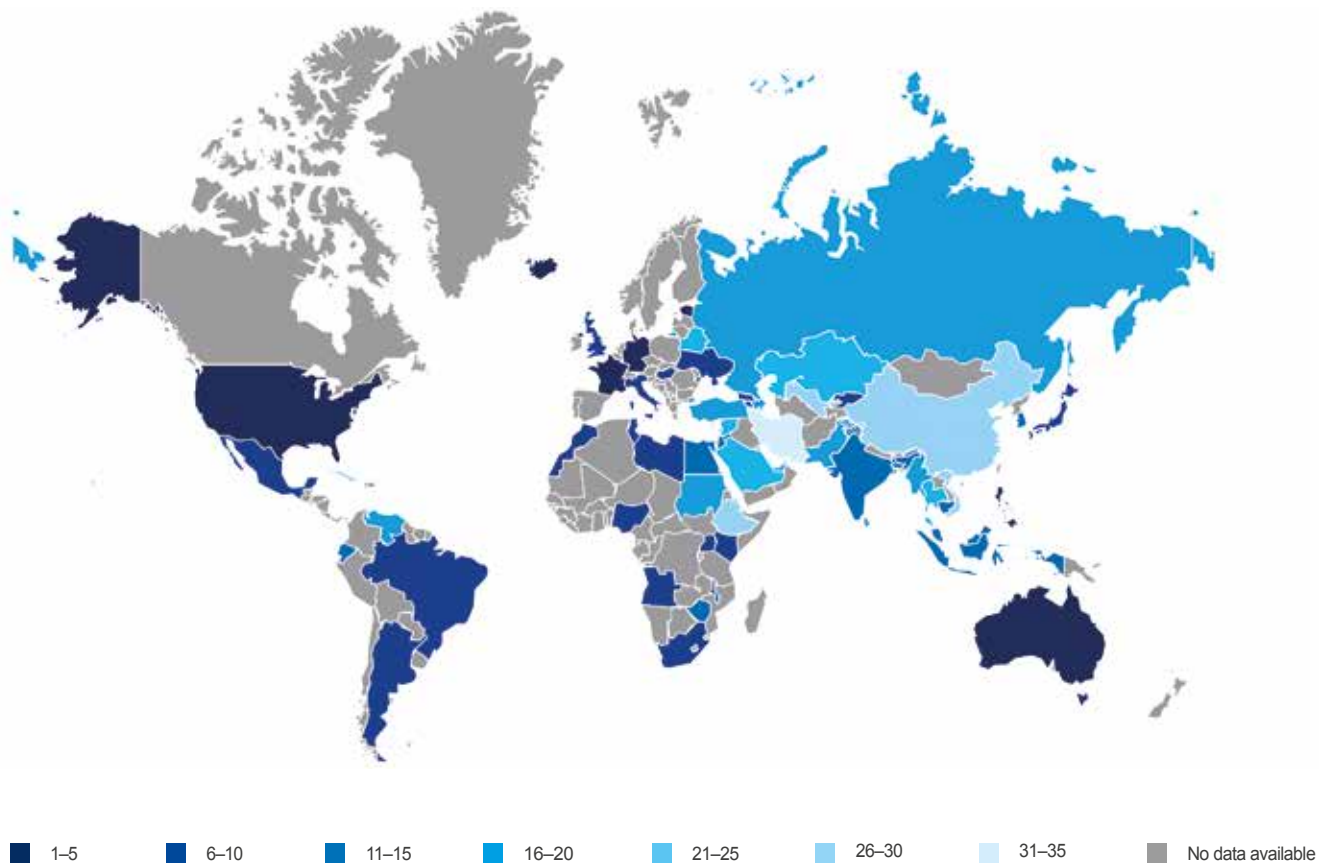
In some countries, the justifications for filtering are existing laws, such as those prohibiting Nazi imagery or child abuse images, which are extended to the Internet. In other cases, laws are passed specifically to block online activities, such as Italy's 2006 *Legge Finanziaria*³² and France's 2011 LOPPSI 2,³³ blocking websites dedicated to gambling and illegal file-sharing alongside pornography.

The enforcement of these laws can be achieved with assistance from different stakeholders. For instance, in the United Kingdom the Internet Watch Foundation (IWF),³⁴ a registered charity, was setup in conjunction with government agencies to help block sites considered illegal on the basis of:

- child sexual abuse images hosted anywhere in the world
- criminally obscene adult content hosted in the UK
- non-photographic child sexual abuse images hosted in the UK

Figure 4.8: Freedom House limits-on-content score

[Source: Freedom house, 2013]

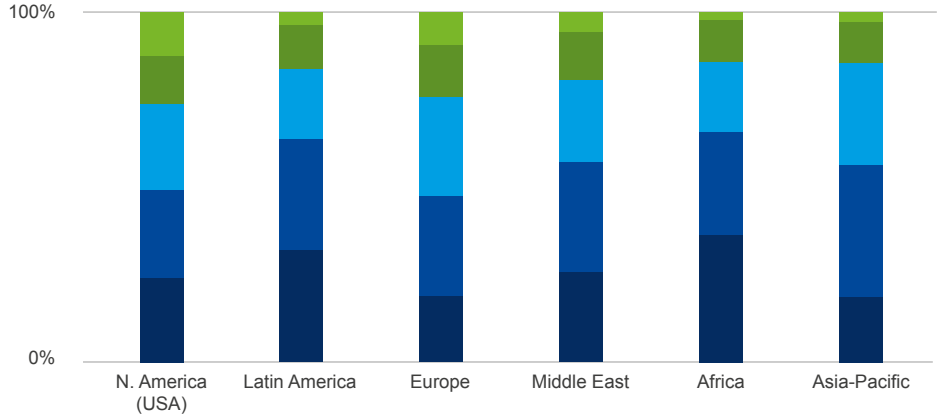


Box 10: Survey results

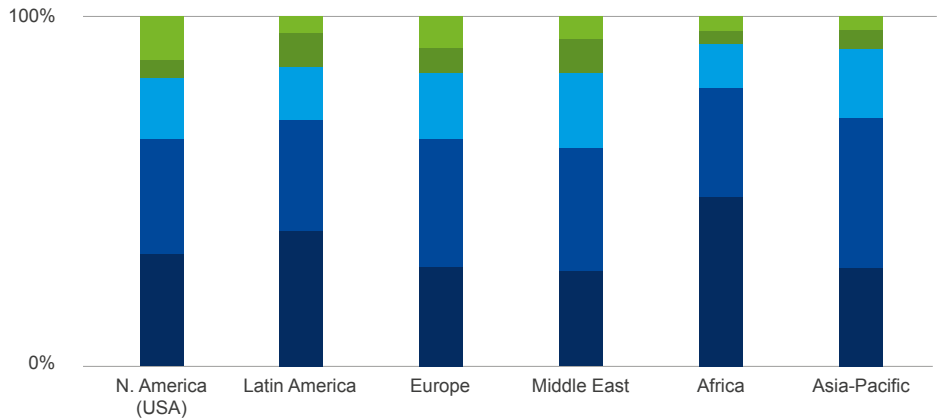
[Source: Internet Society, Global Internet User Survey, 2014]

The Global Internet User Survey asked subscribers a number of questions about the impact of government control over the Internet on freedom of expression and access to content, and the resulting impact on Internet use and growth. The majority of users in all regions strongly or somewhat agreed about the impacts of increased control, particularly so in Latin America and Africa, where the plurality strongly agreed with those sentiments.

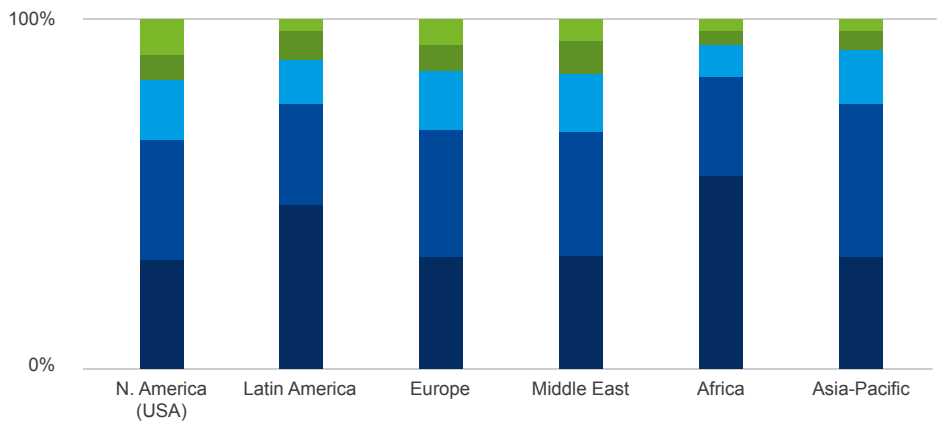
A. Increased government control of the Internet would make me use the Internet less



B. Increased government control of the Internet would inhibit the growth of the Internet



C. Increased government control of the Internet would limit my freedom of expression



■ Don't know / Not applicable
 ■ Strongly disagree
 ■ Somewhat disagree
 ■ Somewhat agree
 ■ Strongly agree

In the case of the IWF, the public assists by reporting individual webpages that are compiled into a blacklist of sites. The blacklist is voluntarily applied by the ISPs responsible for the Internet service of 95% of the UK's customers.³⁵ In addition, the IWF continues to be supported by government and works with police to block illegal content.

However, such services are not infallible and can be responsible for the censoring of content not found illegal by a court of law. In 2008, the IWF blacklisted Wikipedia content relating to a 1976 album by the rock band Scorpion, due to the cover art.³⁶ This blacklist of a single Wikipedia article resulted in many UK Internet users being unable to edit any Wikipedia pages. However, the block was lifted after four days due to "the contextual issues involved in this specific case" including the length of time the album cover in question had already been widely available.³⁷

Likewise, the Australian Communications and Media Authority (ACMA) is responsible for censoring websites in Australia, and it maintains a blacklist of sites with illegal content. This list was leaked online in March 2009 and approximately half of the 2,395 sites included were not illegal, including a Queensland dentist, the site of a school canteen consultancy, and a web hosting and design company based in New South Wales.³⁸ This cast doubt on the ability of governments to filter the Internet without inadvertently blocking legitimate websites.

A number of countries go further, extending online prohibitions to political content. These countries score as among the most restrictive in the *Freedom on the Net study*. For instance, in Bahrain, where the limits-on-content score is 26, the IAA (Information Affairs Authority) is tasked with blocking or shutting down any websites including material "instigating hatred of the political regime",³⁹ giving the IAA free reign to block any site criticising the government or royal family. Of the 1,267 inaccessible-website reports in Bahrain made to monitoring site Herdict⁴⁰ since January 2009, 39% were political sites such as the Bahrain Centre for Human Rights,⁴¹ and a further 23% were social, such as sites for gay dating and social networking services.

China, with an even higher limits-on-content score of 28, applies significant levels of censorship, particularly of international websites,⁴² despite assurances from government officials that "the internet is open".⁴³ Many of these site blocks first came into force in 2009, prior to the 20th anniversary of Tiananmen Square.⁴⁴ As shown in Figure 4.9, blocking based on specific content, such as was done in Pakistan, can extend sometimes to more broad blocks, sometimes with unintended consequences for the rest of the Internet.

The filtering and blocking of Internet content can be circumvented by savvy and, in some cases, daring users; but its reversal can only be brought about by a change in government policies. While it appears that many countries are bringing in new laws to increase censorship, there is some evidence of moves to reduce censorship. For instance, the Burmese government began lifting blocks on foreign websites, such as the BBC and YouTube, in September 2011.⁴⁵ Then, in August 2012, The Press Scrutiny and Registration Department (PSRD) – the Burmese censorship body – announced that pre-publication censorship of both online and offline media, a policy in place for 50 years, would be abolished. Similar policies, lifting blocking orders and opening up access to social media tools, have recently been enacted in Morocco and Tunisia.

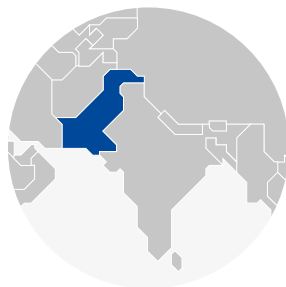
Figure 4.9: Censorship in Pakistan

[Source: Analysys Mason, 2014]

PERIODS IN WHICH YOUTUBE WAS BLOCKED BY PAKISTAN



PAKISTAN



PAKISTAN HAS A HISTORY OF CENSORSHIP WITH REGARDS TO YOUTUBE

2/08

The PTA (Pakistan Telecommunication Authority) first blocked YouTube in **February 2008** for containing “blasphemous content, videos and documents”. The ban was lifted after the site removed “highly profane and sacrilegious footage”.

An error made by Pakistan Telecom in carrying out the government’s ban resulted in YouTube becoming widely inaccessible for over an hour on **24 February**.

5/10

YouTube was again blocked in Pakistan in **May 2010**, due to the use of the site for sharing images of the Prophet Muhammad. The ban was lifted after 8 days; however, links to individual videos with objectionable material remained blocked, as did Facebook, which was seen as the source of the caricatures.

9/12

On **17 September 2012** the PTA blocked YouTube for hosting a trailer of “The Innocence of Muslims”. Due to YouTube’s non-compliance with the Pakistani government’s request to have this video removed, the site has remained blocked. There is an ongoing court case from the human rights group Bytes for All challenging the ban

12/13

In **December 2013** it was announced that an agreement had been reached between the PTA and YouTube for a local version of the site to be made available, YouTube.com.pk
This, if the Pakistani government agrees with Google’s as yet undisclosed conditions, will be the 57th localised version of YouTube to be released

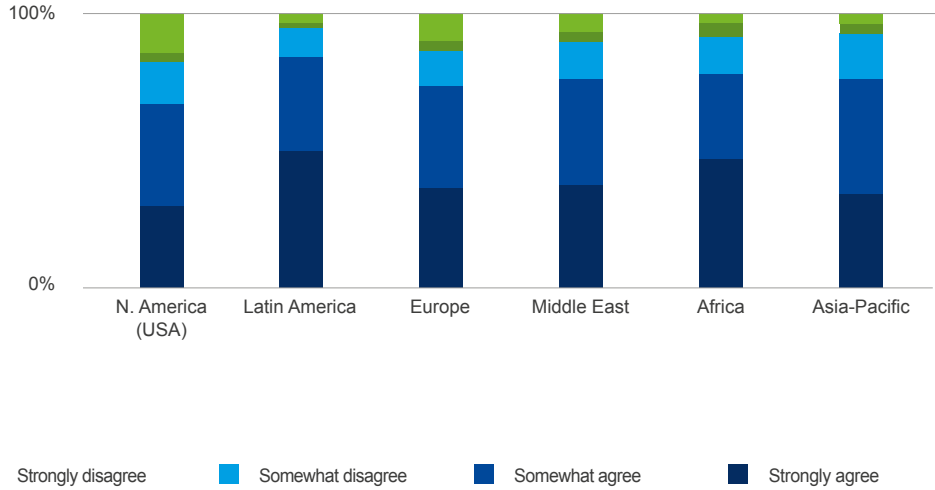
While many governments are using their blocking and filtering powers over network operators for the intended purpose of protecting their citizens, the trend towards more stringent controls does appear to be rising, with new laws being adopted more rapidly than old restrictions are removed. This is leading to a less open Internet, with governments seeking political gain, while users cannot experience the full benefits of the Internet.

Box 11: Survey responses

Before the Internet reaches its full potential in your country people need to be able to access the Internet without data and content restriction

[Source: Internet Society, Global Internet User Survey, 2014]

The majority in all regions surveyed agreed strongly or somewhat that data and content restrictions would limit the ability of the Internet to reach its full potential. Interestingly, the two countries with the least strong support for this proposition were the USA and China, which are at opposite ends of the spectrum for actual limits on content, according to Freedom House.

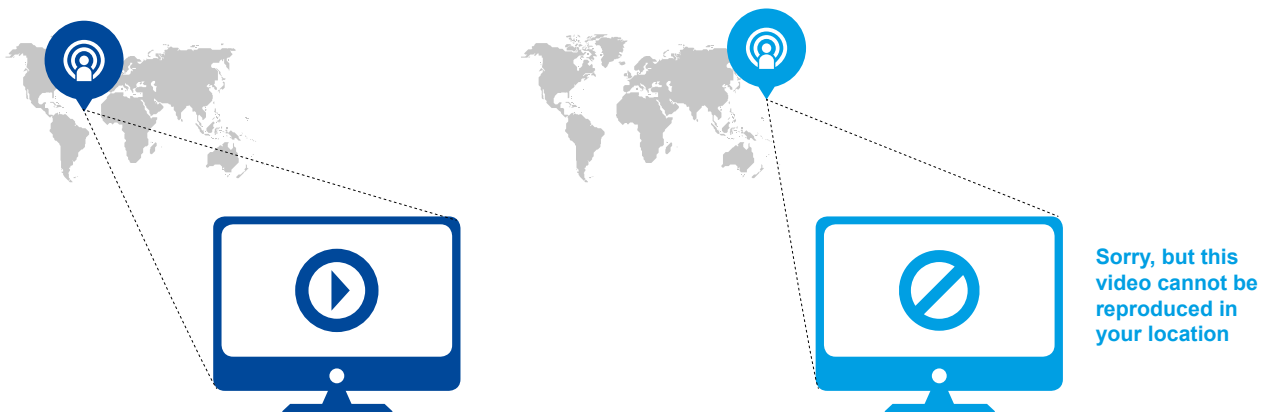


Copyright licensing

Content available in one country may not be available in other countries owing to copyright licensing. In some cases, this could mean that a commercial video service, such as Netflix, is territorially restricted. In other cases, this means that a user in one country may receive a message such as the one reproduced in Figure 4.10 when trying to view a video clip in a country other than the one in which the clip was made available. This can have a significant impact on users' experience, as they cannot always enjoy the full extent of the content otherwise available.

Figure 4.10: Licensing limits

[Source: Internet Society]



Governments grant copyrights, bestowing intellectual property rights that allow the creator of a given piece of content, whether physical or digital, the right to the use and distribution of their work. As a result, copyright holders are able to control access to their works and are responsible for agreements with individual distribution platforms. Such deals are often negotiated on a territorial basis, with the rights not extending beyond international borders.

For instance, BBC iPlayer is a free online catch-up service⁴⁶ available within the UK that enables users to access much of the radio and television-programming broadcast on the BBC throughout the previous week. While some of the BBC content is made available outside of the UK via the BBC iPlayer Global App,⁴⁷ rights agreements mean that the majority of television programmes are only available to users in the UK.

Even within the UK, the cost of acquiring the rights for online distribution of the content means that certain programmes will not be available via iPlayer. Films, international programming, and sporting events in particular are likely to fall into this category due to the cost and complexity involved in obtaining the rights.⁴⁸ For example, when considering the English Premier League, TV and Internet broadcast rights are held by different groups (BSkyB and BT hold TV rights, while News International holds Internet broadcast rights), therefore the BBC would have to acquire the rights to show the football twice if it wishes to also stream the matches online.

Similarly, programming on other catch-up TV services, as well as subscription streaming services, have different content available in different regions. Netflix's director of corporate communications explains the practice this way:

[O]rganizations that own the rights to those shows license the rights by geography. So this means that we have to acquire rights on a territory-by-territory basis. And that's why Netflix is not available everywhere, and where it is available there are differences between Netflix in Brazil and in Sweden or the US.⁴⁹

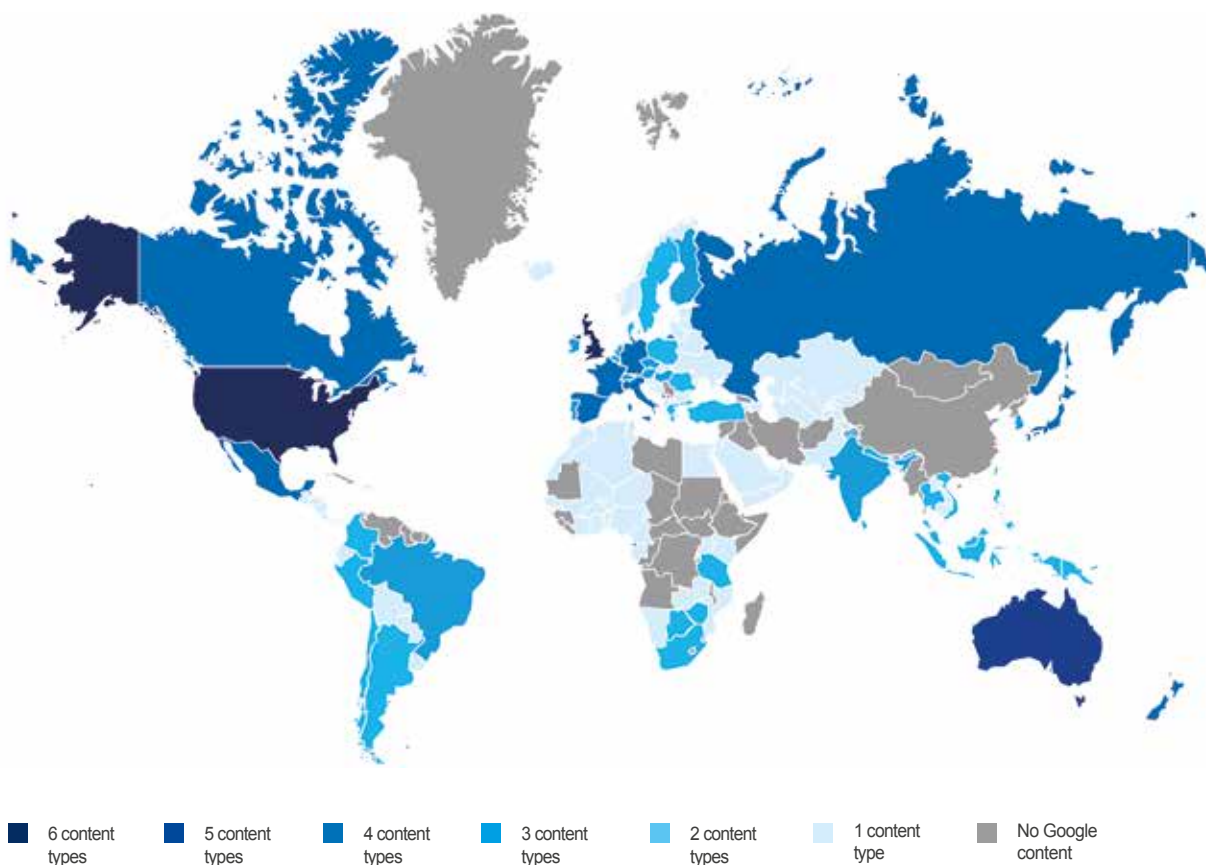
This can have a significant impact on the content available. For example, as of 13 January 2014, Netflix subscribers in the USA had access to 10,463 films or shows, while those in Canada only had access to 3,932.⁵⁰

Similarly, Google Play – offering content for Android devices – has six content categories: paid apps, books, magazines, movies, TV shows, and music; and content availability varies by country. As of January 2014, only customers in the UK

and the USA had access to all of the Google Play content categories.⁵¹ As shown in Figure 4.11, content availability appears to be particularly high in North America, Western Europe, and Australia, high-income countries in which acquiring the rights is more likely to be profitable.

Figure 4.11: Availability of Google content and apps

[Source: Google, 2014]

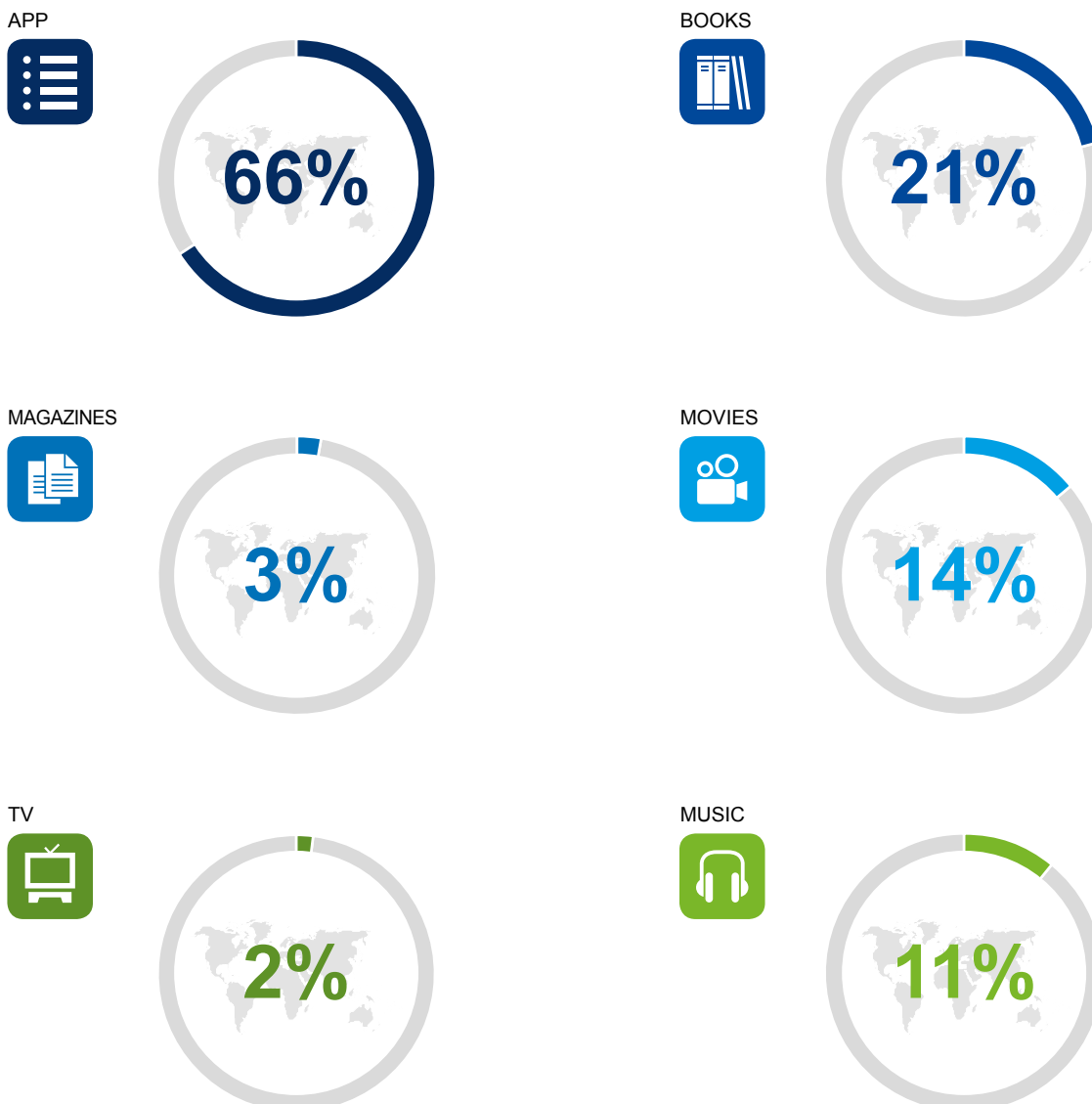


Paid apps are the most prevalent content category available, as shown in Figure 4.12. Unlike the other content categories whose rights Google has to acquire (such as those developed for more traditional platforms such as theatres or television), apps are developed specifically for compatible devices, and thus made available wherever the store is available (unless the app involves licensed content). Thus, we expect that paid apps are available in every country in which the Google Play service is available, for a total of 143 countries. On the other hand, those other content categories, such as books and movies, entail existing licensing arrangements and thus may not be available in every country.

For instance, the popular game app Angry Birds⁵² was developed exclusively for the mobile app platform and is, therefore, made available in every possible country to maximize the size of the addressable market. However, the forthcoming Angry Birds movie is likely to have a more complex release window, owing to traditional movie distribution patterns. The distribution contracts for the movie will be driven by the need to keep intact the entire release window across all platforms, including cinema, DVD, digital downloads, and TV broadcast, and as a result it may not be available on Google Play in many countries where the app is available.

Figure 4.12: Proportion of countries with access to each category of Google content

[Source: Analysys Mason, Google, 2014]



We note also that 33% of countries have no access to any Google Play content, including paid apps. These countries are clustered in developing economies, with 25 in sub-Saharan Africa, 17 in emerging Asia–Pacific and 11 in Central and Latin America. The lack of access to any Google Play content in these countries serves to restrict users from using an increasingly popular service and also inhibits them from developing and selling apps in their own country, where they would have an advantage in targeting apps for their local environment.

Due to the profit-making incentives governing the behaviour of both content rights owners and media broadcast organizations, it is unlikely under the current international licensing regimes that content will become universally available. However, the legality of licensing on a country-by-country basis has been called into question in some cases. In 2011, in the UK, pub landlady Karen Murphy appealed in the European Court of Justice (ECJ) a fine for using a Greek TV decoder to show live Barclays Premier League football matches at a cost lower than that of the local service. On 4 October 2011, the ECJ ruled that:

a system of exclusive licences is also contrary to European Union competition law if the licence agreements prohibit the supply of decoder cards to television viewers who wish to watch the broadcasts outside the Member State for which the licence is granted.⁵³

While this case focused on TV and not Internet rights, court rulings such as this may encourage rights holders to pursue an alternative approach to the licensing of programming, perhaps taking a pan-European tender approach in this example. Regardless of the decisions made by the rights holders, any move towards the ending of exclusive territorial distribution is likely to increase content availability and benefit consumers.

A revision of the licensing regime and copyright laws at regional or international levels could bring about a move towards the liberalisation of content, such that Internet users in the developing world have access to the same resources as those in more developed nations, helping to equalize user experience around the globe. However, even if content is available in a country, there may be other challenges to access the content, based on where it is hosted.

Content divide

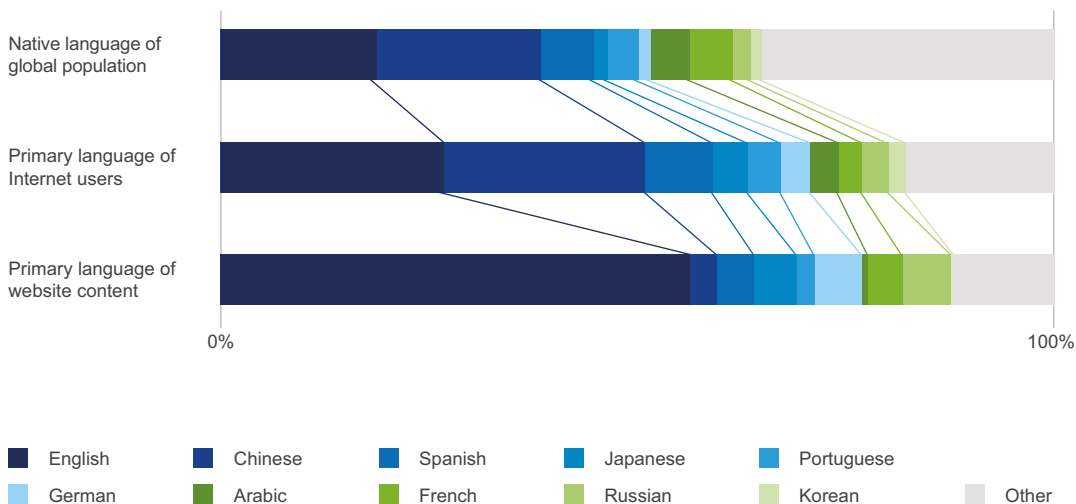
The availability of content – whether licensed or not - does not always translate into usage, for several reasons. First, content must be locally relevant, based on language and context. Second, the location where the content is stored can have a significant impact on the cost and latency of the access, which in turn affects the usage of the content.

Content must be locally relevant for maximal usage, and a key factor in determining the usefulness of content is the language in which that content is provided. Figure 4.13 considers the top ten languages that are spoken as the primary language of Internet users. For each language, the chart compares the proportion of Internet users for whom the language is their primary language with the proportion of Internet websites for which content is primarily provided in that language. By way of comparison, the proportion of the world’s population for whom the language considered is their native language is also provided.

The chart shows that English-speaking Internet users are over-represented compared to global population share, but they also enjoy an abundance of English-language websites compared, for instance, with Chinese-speaking Internet users. While 27% of Internet users are classified as (primarily) English-speaking, more than twice as many websites are classified as offering content (primarily) in English. In contrast, Chinese speakers make up 25% of Internet users, but only 3.3% of websites offer content primarily in Chinese.⁵⁴

Figure 4.13: Proportion of Internet users, websites and native language speakers for the top-ten Internet user languages

[Source: internetworldstats.com, W3Techs, 2014]



Other language challenges relate to differences in alphabet script. Historically, Internet naming has been based on the English alphabet, as encoded in ASCII.⁵⁵ This has significant limitations on the use of domain names for speakers of languages that use other characters, including not just Chinese and Russian, but even languages using the Latin alphabet, which comprises the English alphabet along with diacritical markings, such as the accents used over vowels in French. In 2009, ICANN approved the use of Internationalized Domain Names (IDNs), using non-ASCII characters, which are now in use, and other efforts at the IETF are enabling non-ASCII characters to be used in email headers.⁵⁶

While language is critical, the underlying content must still be relevant to the context of the users. By way of example, *Extra News* is a community newspaper in Chicago, Illinois, which is bilingual in English and Spanish for both print and online versions.⁵⁷ While this is very useful for Spanish-speaking residents of Chicago, it is of no benefit to Spanish speakers in Latin America who would instead benefit from a local newspaper in their own community.

A recent study conducted by the Internet Society, the OECD, and UNESCO titled *The Relationship between Local Content, Internet Development and Access Prices* highlights the benefits of promoting local content that can foster local talent, protect local culture and languages, and create more local traffic.⁵⁸ The study also highlighted policies to help promote local content creation.

However, the availability of local content may still be insufficient to maximize usage by end users, if the content is not easily accessible. According to a recent presentation, the five largest Kenyan websites are all hosted in Europe, along with most international content delivered to Kenya.⁵⁹ Accessing this content from abroad over international links can add significant latency to communications for Kenyan end users; given the cost of those international links, they may be under-provisioned, and the resulting congestion may render the content all but unusable.

As shown in a recent Internet Society study, when Google installed a cache in Nairobi, Kenya, for static content such as YouTube videos, allowing for local access to the videos via the Kenya Internet Exchange Point (KIXP), there was a significant increase in Google usage.⁶⁰ This increased usage came at relatively low cost to the Kenyan ISPs, which did not have to use expensive international submarine cable capacity to access the traffic. In addition, it increased their revenues, based on the usage charge per MB for the additional traffic.

There can, therefore, be significant differences between countries in the latency of access to content. RIPE NCC has a program called Atlas, which distributes probes to users and organizations around the world, which are attached to Internet connections and can be programmed to test latency across these geographies.⁶¹ The Atlas probes were recently configured to test the round trip time needed to access YouTube and Facebook.⁶² Without specifying the location of the server to access, this test measured the end-user experience in accessing www.youtube.com or www.facebook.com.

As shown in Figure 4.14, there are big variations in the median result across countries, with European, developed Asia-Pacific, and North American countries generally having lower latency. These differences in latency can generally be attributed to the quality of the network and how close the content is to the country, either the original in a data centre or a duplicate in a cache.⁶³

Figure 4.14: Median round trip time for YouTube ping

[Source: RIPE Atlas, 2014]

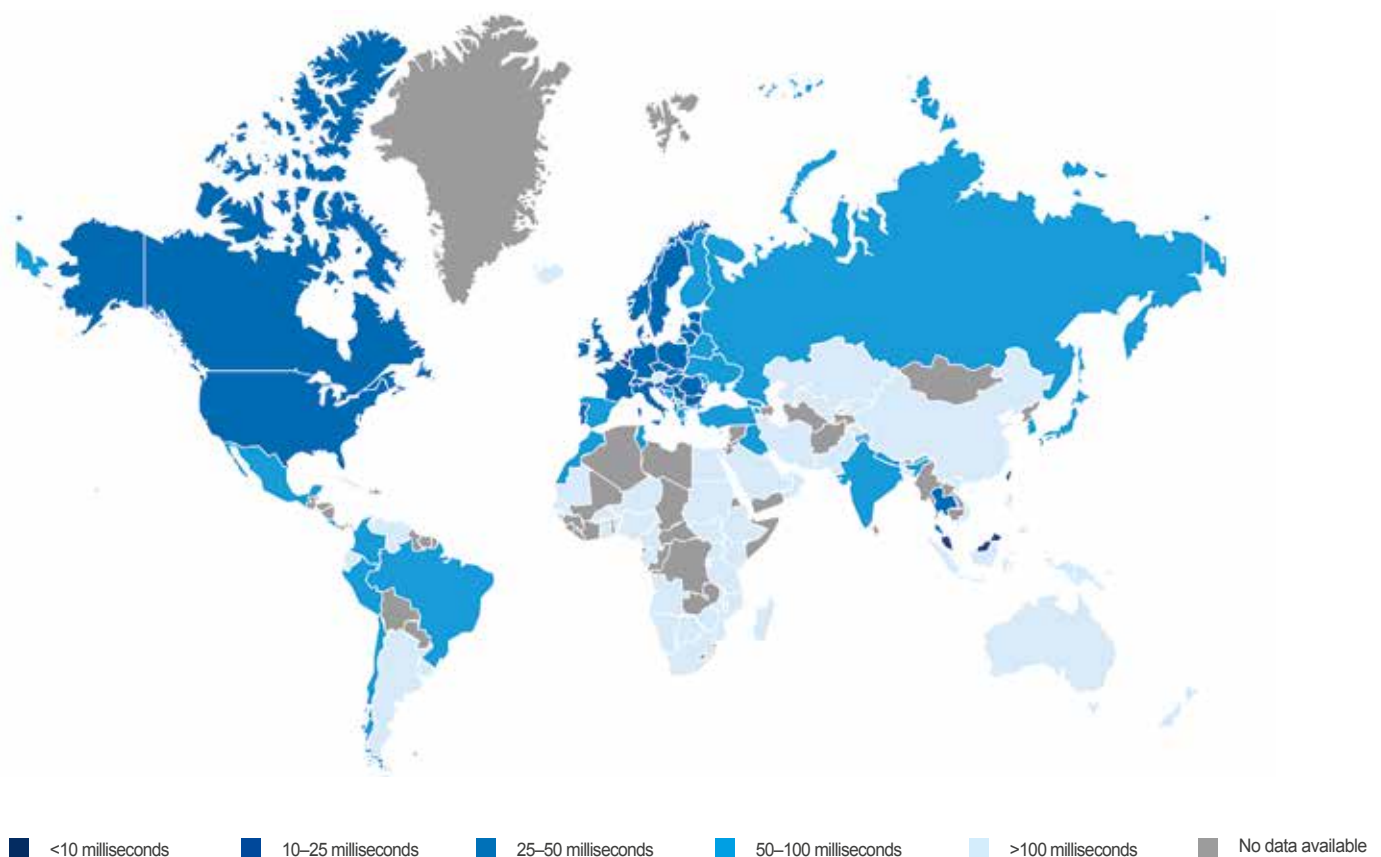


The same test was carried out for Facebook with albeit universally higher latency. As shown in Figure 4.15 it is once again generally the European, developed Asia-Pacific, and North American countries that have lower latency.

The contrast between Facebook and YouTube latencies results in part from differences in the type of content, and in part from different strategies for data delivery. First, YouTube videos are static and, therefore, lend themselves well to caching, while Facebook content is largely dynamic, changing as users continuously update their information. Second, as described above, in order to improve the delivery of videos, Google has introduced caches around the world as part of their Google Global Cache (GGC) program, which extends Google's delivery platform into more than 100 countries.⁶⁴ By contrast, Facebook opened its first data centre outside the United States in mid-2013, and there is no evidence of a widespread international content delivery strategy.⁶⁵

Figure 4.15: Median round trip time for Facebook ping

[Source: RIPE Atlas, 2014]



In summary, to remove disparities in access to locally relevant content, and thereby promote Internet usage, it is important to remove language disparities and foster both the creation and hosting of content that is relevant to local users.

4.4 Internet fragmentation

The examples above represent existing differences in the user experience between countries. While the causes, severity, and timing of these examples are all different, they all share the characteristic of being basically online extensions of offline issues. Countries that ban Nazi imagery offline, ban Nazi imagery online; emerging markets are developing infrastructure in general, including for Internet access; and regimes seeking to repress political protests may extend their efforts to shut down the Internet.

However, a new threat to the Internet experience is emerging in the wake of revelations of pervasive Internet surveillance by state actors, which has altered users' perception of their Internet usage. Perhaps even worse, government responses to this threat could begin to fundamentally fracture the Internet.

On 5 June 2013, the first article was printed based on the material obtained by Edward Snowden, a contractor for the US National Security Agency (NSA). New material has continued to emerge, setting off a series of shocks and aftershocks that continue through this writing.

Trust is the foundation of our online lives, underpinning the benefits outlined in Section 3. Many online activities – ranging from e-commerce to the delivery of government services – depend in some part on users inputting sensitive personal data, such as financial or health records, and relying on it to remain confidential. In other cases, users rely on anonymity to participate in protests or 'whistle blow'.

The revelations detailed an approach to global online surveillance as broad as the Internet itself, and thus what has been revealed has cracked the foundation of trust in the Internet. Users are learning that some providers have enabled access to their data, the providers themselves are learning that their unencrypted transmissions have been tapped, while encryption itself may have been subverted in some cases. Further, governments partnered together in their surveillance efforts, while at the same time they may have spied on each other.

In addition, what is known may only be the tip of the iceberg – in December 2013 an editor of British newspaper the Guardian claimed that only 1% of documents had been released,⁶⁶ while representatives of the US government are seemingly unsure of what is in the remaining 99% of the documents.⁶⁷ One of the journalists who has had access to the Snowden documents since the beginning, Glenn Greenwald, shed some light recently on what is to come, explaining that he views the revelations like a “fireworks show: You want to save your best for last”, with the final big stories coming in June and July 2014.⁶⁸ The uncertainty about what remains stokes doubts about our online privacy and security.

As a result, organisations seek to switch Internet providers, while the providers are changing the way that they supply services. Evidence is already emerging that companies and governments are avoiding companies from the USA and/or solutions that involve storing data in the USA. Estimates for costs to the USA cloud computing and web hosting industry range up to USD180 billion.⁶⁹

In response to these losses, new solutions are emerging to increase users’ control of the storage of their information. Microsoft for example declared recently that it would enable its users to choose the country in which their personal information is stored. As explained by Brad Smith, general counsel of Microsoft: “People should have the ability to know whether their data are being subjected to the laws and access of governments in some other country and should have the ability to make an informed choice of where their data resides.”⁷⁰

More fundamentally, a number of governments are debating requirements for national service delivery, which would act to localize Internet services within their borders. For instance, Brazil considered amendments to the *Marco Civil da Internet* bill, which would have required large content providers such as Google or Facebook to store user data on Brazilian territory.⁷¹ While this clause was omitted from the legislation that was finally adopted, other countries have examined similar initiatives.⁷²

Requirements of local data processing could have substantial implications for Internet companies, with increased costs as a result. As an example, a recent study by the Brazilian telecommunications group Brasscom found that the operating costs of a data centre in Brazil can be up to 100 per cent higher than in the USA, mainly due to electricity costs and taxation.⁷³ While Brazil chose not to require local data processing, the same cost dynamic may be true in other countries, which could act as a barrier to entry for companies.

The results of any data localisation requirements would be unique in several ways. The very goal of these policies would be to separate one country's Internet experience from another's, with potentially irreversible consequences. Requirements to store or process data locally could lead to some companies declining to offer service in particular countries owing to the increased cost. At the same time, local companies, which could benefit from those policies, might find it difficult to expand to other countries with similar policies, a result akin to the 'beggar thy neighbour' trade wars of the 1930s.⁷⁴

4.5 Conclusion

In spite of the singular success of the Internet in creating a global platform, connecting nearly 3 billion users together to reap the many benefits of the open Internet, there are still significant differences in user experience between countries. Some of these differences arise from economics – richer countries can afford to invest more for infrastructure than poorer countries. Further, even where private sector investment has resulted in advanced mobile networks in a number of developing countries, effectively leapfrogging legacy fixed networks, penetration is lower because of lower income levels.

At the same time, business decisions can have an impact on the availability and provision of capacity for Internet access, affecting the download speeds and quality of service experienced by the users. Further, similar decisions can influence the amount of content available in a country along with the location where the content is hosted, which in turn can have consequences regarding what users can access online and the quality of the access.

Of course, businesses are affected by government policy and regulations, which can create an enabling environment for Internet access and services. For instance, the diversity of international interconnections can have an impact on the resilience of the network, and diversity can be increased by government decisions regarding the ownership of the incumbent and the entry of competition. Further, several governments have imposed restrictions on content availability within their borders and also have taken steps in recent years to shut down the Internet at the borders for varying lengths of time. These decisions can have repercussions for the usage of the Internet within a country and for the willingness of companies to invest in providing access and content. In the next section, we turn to recommendations for addressing the challenges raised here.



SECTION 05

Recommendations

5.1 The Internet is for Everyone

Although the Internet is held together by a global set of standards, we have shown here that there are divisions in the user experience between countries. Further, in spite of the striking, once unimaginable, growth in Internet adoption and usage, the majority of the world population is still not online. Addressing the challenges in the previous section will not just improve the user experience of those currently online, but will also contribute to the Internet Society's overarching vision, that the Internet is for Everyone.

As we see in Section 1, progress towards our vision is proceeding quickly around the world, as access continues to grow at a significant pace. However, much development work remains to be done to bring the economic and social benefits of the Internet to everyone. Further, those who are online are experiencing significant variations in their user experience.

For non-Internet users, sitting on the other side of the so-called digital divide, Internet access is clearly a critical component. With the advent of mobile broadband, which can be rolled out faster and at lower cost than fixed broadband, access is no longer as critical an issue. Nonetheless, affordability remains as a significant roadblock. As we showed in Section 4, the average cost of broadband access in many countries is still too high, and in some countries is even greater than the average income of the citizens.

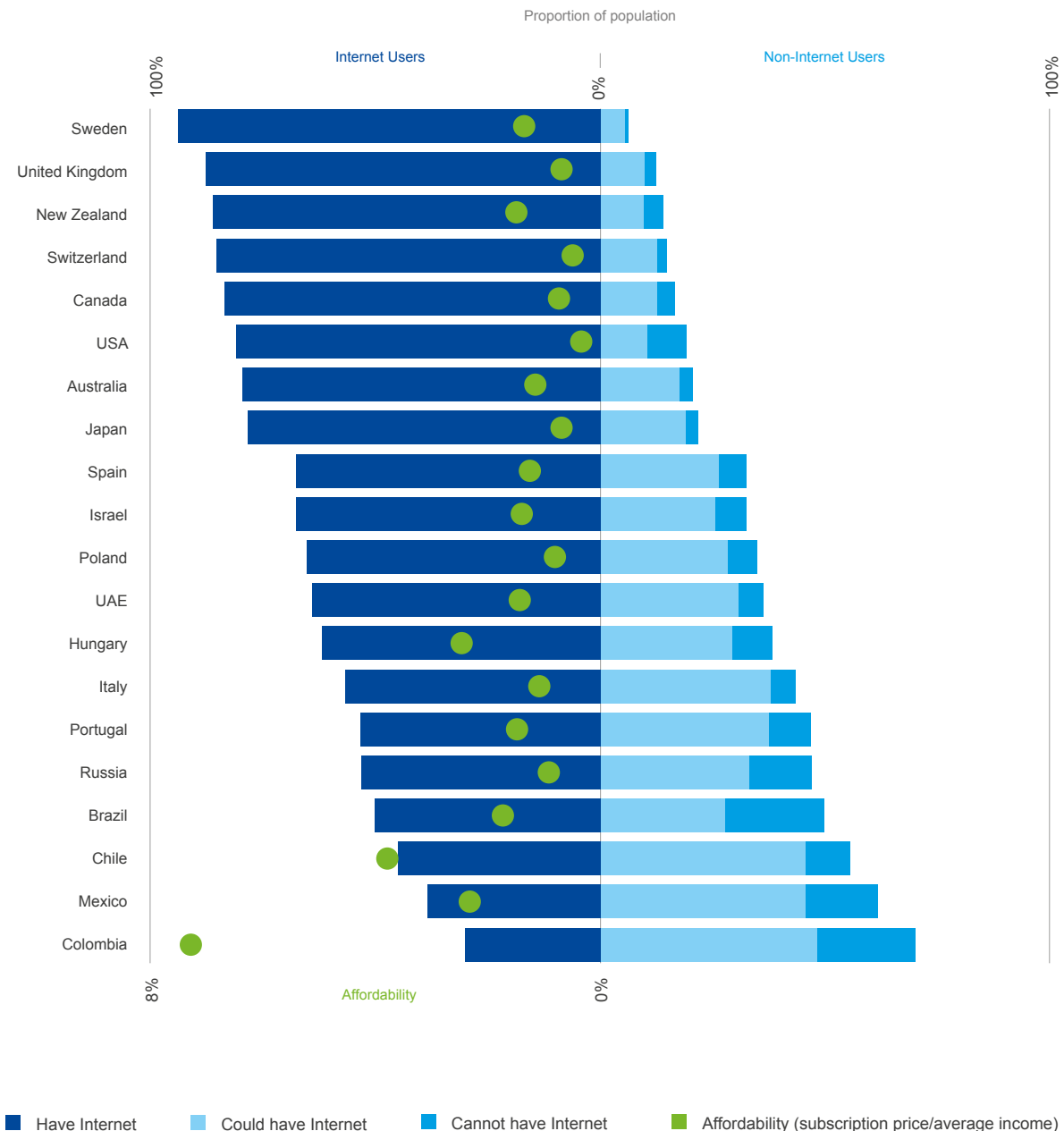
However, there is evidence that among those who have access to the Internet and are able to afford it, there are still many who choose not to go online. The PewResearch Internet Project published the results of a May 2013 survey in the United States, which revealed that 15% of American adults did not use the Internet at all. Asked why, 34% of non-users claimed that the Internet is not relevant to them and 32% do not like to use the Internet because it is difficult to use, while only 19% cite the cost and 7% the lack of availability.

Similar results are found for other developed and emerging countries. In a series of annual reports, the World Internet Project polled non-adopters in a variety of countries to find their reasons for not going online, with the possible choices including "No interest/Not useful", "Don't Know How to Use/ Confused", "No Computer/Internet", "Too Expensive", or "No Time".

We interpret that the traditional digital divide, relating to lack of access or affordability, pertains to those who answered “No Computer/Internet” or “Too Expensive”, while for the others the primary reason was a lack of training, or interest, or the time to access the Internet. In almost every country polled, regardless of affordability, more non-users cited a lack of interest than availability or affordability, as shown below, in Figure 5.1.

Figure 5.1: Population of Internet users and non-users

[Source: Survey responses: Mexico, Poland, Russia, Sweden, United States, World Internet Project International Report 5th Edition (2013), Australia, Canada, Italy, New Zealand, Spain, Switzerland, United Kingdom World Internet Project International Report 4th Edition (2012), Hungary, United Arab Emirates, Chile, Israel, Japan, Portugal, World Internet Project International Report 3rd Edition (2011). Affordability data: ITU 2013 Measuring the Information Society. Internet penetration data: ITU 2013, 2012, 2011.]



As a result, when considering how to increase Internet penetration, it is important to differentiate those who could have Internet access, but lack the interest, or training, from those who do not have access or could not afford it anyway. For those who cannot have Internet, significant efforts are underway at the national and international level to study and address the issues of the digital divide. For instance, the Broadband Commission for Digital Development aims to expand broadband access, while the Alliance for Affordable Internet (A4AI) works to see the Broadband Commission affordability target realised. The World Bank, Inter-American Development Bank, regional clusters of countries, and many, if not most, national governments are also working on a variety of means to increase Internet access and affordability.

What is noticeable in the previous graph, however, is that the proportion that seemingly could have Internet access, but choose not to take it, remains significant, even in the countries with lower penetration rates (and generally lower affordability). This likely has to do with the fact that while the Internet is an unparalleled network for facilitating global access, the local experience is also critical. In countries with fewer users, the Internet for many is less critical to everyday life, since there are fewer local friends and family to contact, businesses are less likely to arise to sell to a smaller market, and the government cannot focus on the online experience at the expense of the majority who are still offline. As a result, non-users may be prone to express less interest in the Internet, which serves to maintain a lower penetration status quo.

In addition to efforts to bridge the digital divide and increase interest in the Internet among non-users, it is also important to address the issues raised in Section 4 that impact those already online, such as security and privacy concerns. Addressing those issues will not just impact those already online, but improve the experience for those considering going online.

Based on the issues raised above, we think that the issues in the following table should be addressed to improve the Internet experience and increase access.

We note that any improvements for one group provide potential benefits for the subsequent group of adopters. For instance, addressing issues faced by current users, such as privacy concerns, will also make the Internet more attractive to those who have chosen not to access the Internet yet, while addressing the content divide will make the Internet more attractive to those for whom access is not yet possible.

Group	Issue	Remedy
<i>Have Internet access today</i>	Resilience	Increase diversity in two ways: first, increase operator diversity by liberalising the international gateway market, lowering licensing costs, and reducing other barriers to the development of international and domestic connectivity; second, increase network and route diversity by working at the regional levels to reduce barriers to cross-border connectivity so that more cross-border infrastructure can be deployed and interconnected. The Internet Society has made it a key priority to advance the deployment of core Internet infrastructure and evolution of technology to ensure the sustainability and reliability of the Internet. This work includes extending our work in developing Internet Exchange Points and addressing barriers to connectivity.
	Security and privacy	If the “Internet” becomes the “monitored Internet”, many of the economic and social benefits that have emerged over the last 10 years will simply disappear. One country, one stakeholder group or one individual cannot overcome this threat alone: but one country can, through local policies, pose a significant threat to the Internet as a global tool for social good. There is a real need for the global community to come together to agree on strong ethical principles for Internet data-handling. The Internet Society has made it a key priority to promote the robustness and resiliency of Internet security and privacy through technology standards and deployment.
	Content availability	Content is the key driver and main facilitator for the Internet’s presence and future. The Internet has provided users with the ability to become authors, creators, and publishers, while, at the same time, engaging in various forms of social interaction. Users depend on the Internet to retrieve information, exchange knowledge and know-how, interact with their peers, and contribute to various discussion fora. The Internet Society has made it a priority to seek ways to create an enabling environment for the creation, access, use, and dissemination of content on the Internet.
<i>Could have access today</i>	Content access	Countries should create an enabling environment for companies to deploy caches or servers to hold local or international content. As users connect to the Internet and are exposed to an unlimited and boundless amount of content, they are incentivized to create their own content and share their own ideas. Supporting and facilitating an Internet environment where content is not subjected to policy restrictions – be it in the form of liability or otherwise – is pivotal for a robust Internet ecosystem.
	Content creation	In order to help develop locally relevant content, governments can seed the market by developing their own content. In addition to extending the reach of government services, this can help to create online demand to access these services; create demand for data centres to hold the government servers; increase usage of an Internet Exchange Point, if available; and create jobs for local developers who can begin to innovate and create private content and applications for the market.
<i>Cannot have Internet today</i>	Access	In addition to the actions described above to address resilience issues, governments can remove domestic barriers to connectivity, such as high costs of accessing rights-of-way for deploying fibre, and for building cell phone towers. In addition, the government can facilitate infrastructure sharing using government property, such as deploying fibre ducts next to roads, railroads, or using electricity transmission networks, and encourage or require sharing of private infrastructure, including towers and existing networks.
	Affordability	Many actions outlined above will act to lower costs, by lowering the cost of deploying infrastructure and of accessing local content. Additional actions can include removing taxes on equipment, devices, and services that could act to depress demand. Finally, to the extent that a country has a universal service obligation fund, it could be used to subsidize construction of Internet access infrastructure in high-cost areas or to subsidize demand in low-income areas.

5.2 Conclusion

As we near three billion Internet users, it is appropriate to step back and marvel at the speed of adoption and changes that have taken place to date. The multistakeholder model that was central to the creation of the Internet has evolved and grown to encompass Internet governance and key development projects such as IXP creation.

As we look forward to the fourth billion user and beyond, it is clear that it will be as difficult to forecast the twists and turns we will collectively face as it would have been to forecast all the events of the past ten years. It is remarkable that only in 2004 did fixed-broadband exceed dial-up access, or that the first smartphone was only introduced in 2007. How many of us could have imagined back then that mobile broadband would so soon surpass fixed, developing country users surpass developed country users, and video traffic surpass all other?

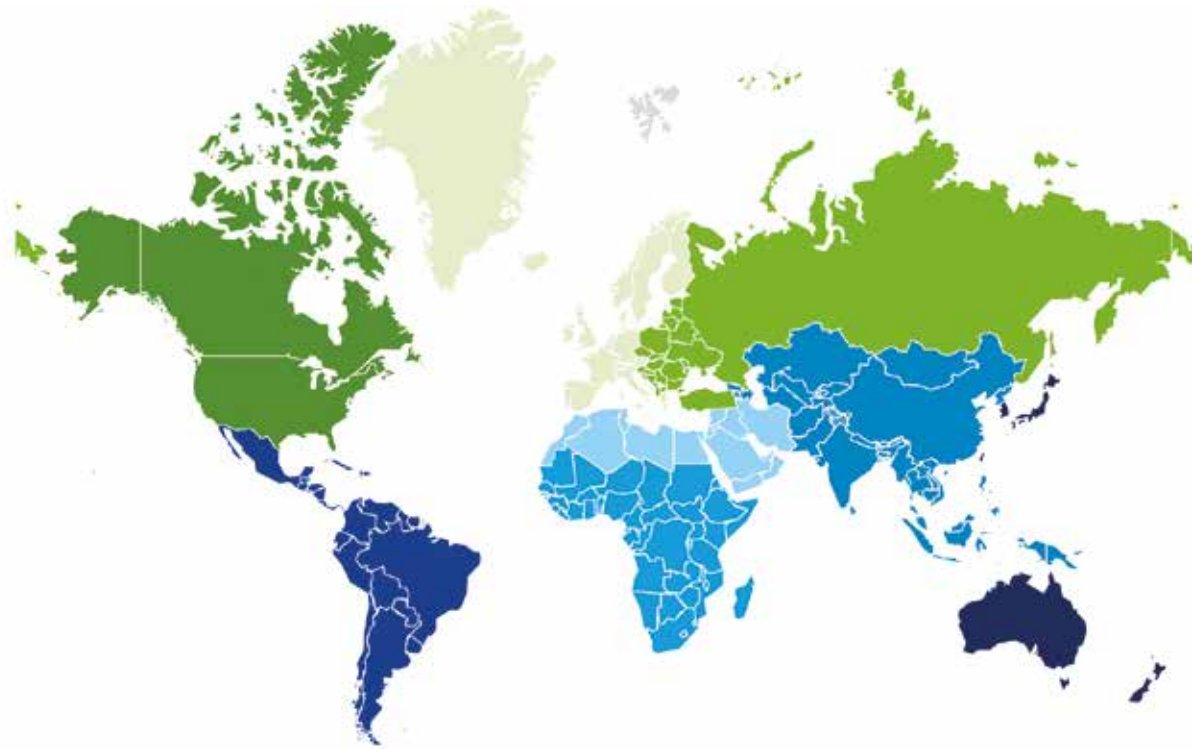
What is clear, however, is that the open Internet model, which helped to fuel the growth and navigate all the bumps in the road, continues to be the best way to ensure that the Internet remains sustainable and continues to grow. How else could an engineer in Togo raise money from strangers in Europe, design and build a USD100 3D printer made of e-waste, and submit his design for consideration to the US space agency, NASA? Or a teenager in Mongolia have his potential identified and end up a student at MIT? Or a new political party, led by an Italian comedian, organize a cost-free online primary, and within four years secure more seats in the House of Deputies than any other party?

Working together, and honouring the Internet model, all the stakeholders can meet the foreseen challenges outlined in this section – and others as they arise – to make the Internet yet more essential to end-users lives as citizens, consumers, and innovators. At the same time, we can address the digital divide that separates regions and people, and make sure that once online, everyone has the same user experience. With universal and uniform online access, anything is possible.

Annex A Definition of world regions

Figure A.1: Definition of world regions

[Source: Analysys Mason, 2013]



WESTERN EUROPE

- Andorra
- Austria
- Belgium
- Cyprus
- Denmark
- Finland
- France
- Germany
- Greece
- Iceland
- Ireland
- Italy
- Liechtenstein
- Luxembourg
- Malta
- Monaco
- Netherlands
- Norway
- Portugal
- San Marino
- Spain
- Sweden
- Switzerland
- United Kingdom

CENTRAL AND EASTERN EUROPE

- Albania
- Belarus
- Bosnia and Herzegovina
- Bulgaria
- Croatia
- Czech Republic
- Estonia
- Hungary
- Latvia
- Lithuania
- T.F.Y.R. Macedonia
- Moldova (Rep. of)

- Montenegro
- Poland
- Romania
- Russian Federation
- Serbia
- Slovakia
- Slovenia
- Turkey
- Ukraine

NORTH AMERICA

- Canada
 - United States of America
- DEVELOPED ASIA-PACIFIC**
- Australia
 - Brunei Darussalam
 - French Polynesia
 - Guam
 - Hong Kong (S.A.R.)
 - Japan
 - Macao (S.A.R.)
 - New Caledonia
 - New Zealand
 - Northern Marianas Islands
 - Singapore
 - Korea (Rep. of)
 - Taiwan, Province of China

EMERGING ASIA-PACIFIC

- Afghanistan
- American Samoa
- Armenia
- Azerbaijan
- Bangladesh

- Bhutan
- Cambodia
- China
- Cook Islands
- Fiji
- Georgia
- India
- Indonesia
- Kazakhstan
- Kiribati
- Kyrgyzstan
- Lao P.D.R.
- Malaysia
- Maldives
- Marshall Islands
- Micronesia (Fed. States of)
- Mongolia
- Myanmar
- Nauru
- Nepal
- Niue
- Dem. People's Rep. of Korea
- Pakistan
- Palau
- Papua New Guinea
- Philippines
- Samoa
- Solomon Islands
- Sri Lanka
- Tajikistan
- Thailand
- Timor-Leste
- Tonga
- Turkmenistan
- Tuvalu
- Uzbekistan
- Vanuatu
- Viet Nam

MIDDLE EAST AND NORTH AFRICA

- Algeria
- Bahrain
- Egypt
- Iran (Islamic Rep. of)
- Iraq
- Israel
- Jordan
- Kuwait
- Lebanon
- Libya
- Morocco
- Oman
- Palestine (State of)
- Qatar
- Saudi Arabia
- Syrian Arab Republic
- Tunisia
- United Arab Emirates
- Yemen

LATIN AMERICA AND CARIBBEAN

- Anguilla
- Antigua and Barbuda
- Netherlands Antilles
- Argentina
- Aruba
- Bahamas
- Barbados
- Belize
- Bermuda
- Bolivia (Plurinational State of)
- Brazil
- Cayman Islands
- Chile
- Colombia
- Costa Rica
- Cuba
- Dominica

- Dominican Republic
- Ecuador
- El Salvador
- Grenada
- Guatemala
- Guyana
- Haiti
- Honduras
- Jamaica
- Mexico
- Montserrat
- Nicaragua
- Panama
- Paraguay
- Peru
- Puerto Rico
- Saint Kitts and Nevis
- Saint Lucia
- Saint Vincent and the Grenadines
- Suriname
- Trinidad and Tobago
- Turks and Caicos Islands
- Uruguay
- Venezuela (Bolivarian Republic of)
- Virgin Islands (British)
- Virgin Islands (US)

SUB-SAHARAN AFRICA

- Angola
- Benin
- Botswana
- Burkina Faso
- Burundi
- Cameroon
- Cabo Verde
- Central African Republic
- Chad
- Comoros
- Congo

- Côte d'Ivoire
- Congo (Dem. Rep. of the)
- Djibouti
- Equatorial Guinea
- Eritrea
- Ethiopia
- Gabon
- Gambia
- Ghana
- Guinea
- Guinea-Bissau
- Kenya
- Lesotho
- Liberia
- Madagascar
- Malawi
- Mali
- Mauritania
- Mauritius
- Mayotte
- Mozambique
- Namibia
- Niger
- Nigeria
- Reunion
- Rwanda
- Sao Tome and Principe
- Senegal
- Seychelles
- Sierra Leone
- Somalia
- South Africa
- Saint Helena
- Sudan
- Swaziland
- Tanzania (United Rep. of)
- Togo
- Uganda
- Zambia
- Zimbabwe

Regional groupings according to Analysys Mason; Country names from United Nations Statistical Division

Annex B Global Internet User Survey 2013 methodology

The Global Internet User Survey (GIUS) was commissioned by the Internet Society and conducted among 10,500 Internet users across 20 countries. All were people who have access to the Internet, either at home, at work, or via mobile access. People with no access to the Internet, or who choose never to access the Internet, are excluded from the study.

Redshift Research conducted the interviews online in December 2013 and January 2014 using an email invitation and an online survey. Respondents were drawn from online consumer panels in the relevant target countries.

Figure B.1: Survey responses
Gender distribution

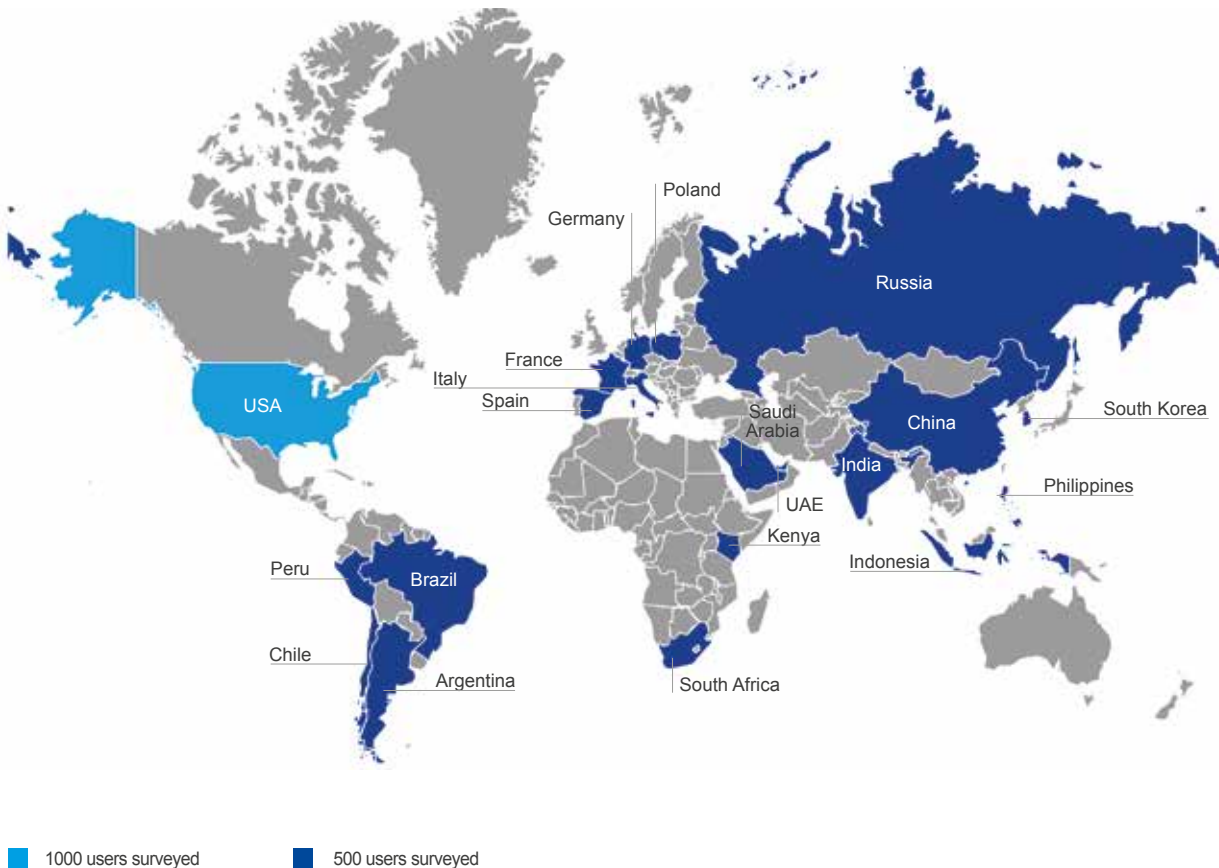
[Source: Internet Society, Global Internet User Survey, 2014]



Figure B.2: Survey responses

Participating Countries

[Source: Internet Society, Global Internet User Survey, 2014]



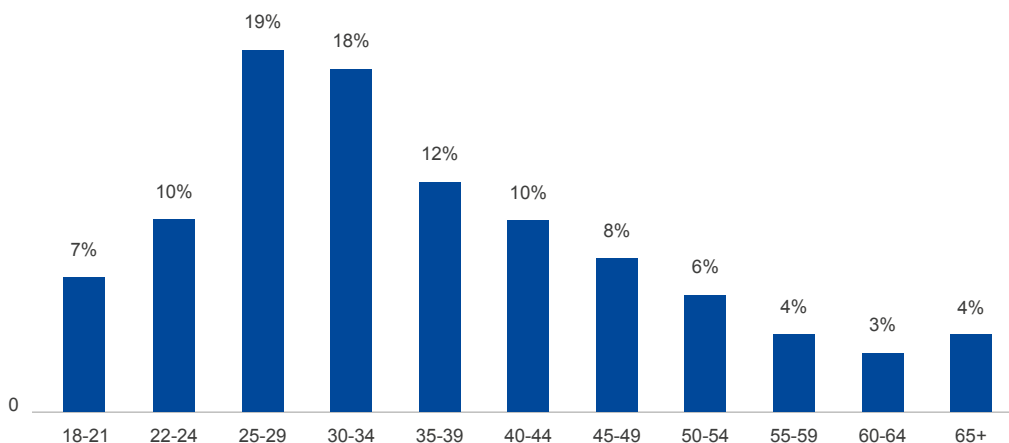
Results of any sample are subject to sampling variation. The magnitude of the variation is measurable and is affected by the number of interviews and the level of the percentages expressing the results. In this particular study, the chances are 95 in 100 that a survey result based on all 10,500 respondents does not vary, plus or minus, by more than 1% from the result that would be obtained if interviews had been conducted with all persons in the group represented by the sample. Results based on the sub-samples in individual countries, being smaller (typically 500 in each country) will be subject to a greater degree of error as a result (up to +/- 4.4% at 95% confidence limits).

The sample was selected from a variety of consumer panels in each country. Every effort was made to ensure that the final sample structure was as representative of the local population of Internet users (in terms of age and gender) as possible (remembering that the Internet population is not necessarily the same as the general population). In developed economies, such as the USA and western European countries, the population of Internet users has a very similar profile to the general population (as Internet use is now extremely widespread). However, it should be noted that in developing countries, the Internet population may well have a younger age bias or, in some instances, be more male-dominated than the general population. In general, the panel composition in each country represents a live record of Internet users that is broadly representative of the Internet population at that point in time.

Figure B.3: Survey responses

Age distribution

[Source: Internet Society, Global Internet User Survey, 2014]



References

CHAPTER 1 - THIS IS YOUR INTERNET: TRENDS AND GROWTH

1. "ITU releases 2014 ICT Figures", 5 May 2014, http://www.itu.int/net/pressoffice/press_releases/2014/23.aspx#U23BbV73qQk
2. All ITU statistics used in this section can be found at <http://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx>.
3. The definitions of each region we refer to in this report are set out in Annex A. The ITU will release country data for 2013 after the deadline for printing this report. As a result the regional level data in Figure 1.3 and other figures that rely on ITU country level data will be for 2012 in the print version. However, we will update the data online, at <https://www.internetsociety.org/global-internet-report>.
4. The five RIRs are:
 - African Network Information Centre (AfriNIC) serving Africa
 - American Registry for Internet Numbers (ARIN) serving the United States, Canada, and many Caribbean and North Atlantic islands
 - Asia-Pacific Network Information Centre (APNIC) serving the Asia-Pacific region
 - Latin American and Caribbean Network Information Centre (LACNIC) serving Latin America and parts of the Caribbean
 - Réseaux IP Européens Network Coordination Centre (RIPE NCC) serving Europe, the Middle East, and parts of Central Asia.
5. See <http://www.internetsociety.org/what-we-do/internet-technology-matters/ipv6>.
6. A /8 ("slash 8") is a Classless Inter-Domain Routing (CIDR) block containing 16,777,216 addresses. There are 256 /8 blocks in the IPv4 address space.
7. See Section 3 for examples of the uses and benefits of the Internet today.
8. These numbers come from the Internet Domain Survey conducted by the Internet Systems Consortium. For more details, see <https://www.isc.org/services/survey>.
9. ISC's definition of a host is "a domain name that has an IP address (A) record associated with it. This would be any computer system connected to the Internet (via full or part-time, direct or dialup connections). ie. example.com, www.example.com". See ISC's definitions: <https://www.isc.org/services/survey/definitions>.
10. Broadband access networks can be used by network operators to deliver managed Internet services, such as IP television (IPTV), which we do not address in this report.
11. Broadband is defined as speeds above the 0.128Mbit/s available on a narrowband network
12. In addition to traditional fixed connections, we include fixed wireless here. Fixed wireless broadband uses radio waves to transmit data to the customer, but using equipment that is not easily moved – this could include an outdoor antenna, and it is typically connected to a computer rather than a tablet or smartphone.
13. Video applications are defined here as including downloads and streaming, as well as short-form video such as YouTube, and webcam viewing.
14. Cisco Visual Networking Index (VNI), http://www.cisco.com/web/solutions/sp/vni/vni_forecast_highlights/index.html.
15. See Sandvine Global Internet Phenomena 2H 2013: <https://www.sandvine.com/trends/global-internet-phenomena>.
16. See OECD Broadband Portal: <http://www.oecd.org/sti/broadband/oecdbroadbandportal.htm>.
17. We expect that the majority of mobile access subscriptions will be mobile broadband services. However, this is difficult to assess precisely because the number of 2G mobile subscriptions that are, at least in part, used for Internet access is not known.
18. Here, mobile broadband connections comprise 3G and 4G handsets, mid-screen devices, dongles, routers, and machine-to-machine (M2M) connections.
19. Fixed line services are typically purchased on a per-household basis. Mobile services, on the other hand, may be purchased by each individual within a household. In some cases, individuals may even have more than one mobile access device (e.g., a smartphone, a laptop, and a tablet). On the other hand, as mentioned above, in other cases individuals within a household may share one device.
20. This is the most popular video application on mobile in North America, unlike for fixed connections, where it is Netflix.
21. YouTube traffic fell from a peak of nearly 25% of peak mobile traffic in the first half of 2013. See Sandvine Global Internet Phenomena H2 2013: <https://www.sandvine.com/trends/global-internet-phenomena>.
22. Features include Dual SIM, QWERTY keypad, SD card slot up to 32GB, Internal memory 64MB, Stereo FM radio, Wi-Fi, 2.0 MP camera, MP3/MP4. See MTN Zambia list of smartphones: <http://mtnzambia.com/index.php/en/personal/shop/smart-phones>.
23. The Tecno M3 has the Android 4.2 Jelly Bean operating system, a dual-core processor, video calling and accelerated graphics, See Price in Kenya: <http://www.priceinkenya.com/tag/0-9-999>.
24. See the UK Department for Culture, Media & Sport, "The UK Spectrum Strategy": <https://www.gov.uk/government/publications/spectrum-strategy>.

25. A 2011 Real Wireless report for Ofcom on 4G capacity gains found that a 1.2 times improvement in spectral efficiency was realistic between high-end 3G networks and initial 4G network deployments. See: http://www.apwpt.org/downloads/ofcommay2011_4gcapacitygainsfinalreport_main.pdf. However, this difference is expected to grow with future 4G releases.
26. See Moore Stephens "Africa Desk News Bulletin": http://www.moorestephens.co.za/images/uploads/MS-Africa_News_Desk_Kenya.pdf.
27. See Safaricom Ltd Hi FY14 Presentation, 5th November 2013: http://www.safaricom.co.ke/images/Downloads/Resources_Downloads/Half_Year_2013-2014_Results_Presentation.pdf?itembanner=31.
28. For mobile phone, Y0 may be a few years after the initial launch of the technology and, in fact, in line with when penetration levels of any note arose and were reported.
29. These launch dates are common to all the developing regions shown in the charts, aside from Latin America, for which the cellular Y0 is 1994.
30. For all of the results and a description of the methodology, see <https://www.internetsociety.org/survey>.

CHAPTER 2 - OPEN AND SUSTAINABLE INTERNET

1. For a brief history of the Internet, written by a number of its founders, including Barry M. Leiner, Vinton G. Cerf, David D. Clark, Robert E. Kahn, Leonard Kleinrock, Daniel C. Lynch, Jon Postel, Lawrence G. Roberts, and Stephen Wolff, see <http://www.internetsociety.org/internet/what-internet/history-internet/brief-history-internet>.
2. See NTIA's Press Release: <http://www.ntia.doc.gov/press-release/2014/ntia-announces-intent-transition-key-internet-domain-name-functions>.
3. For the Internet Society's statement, see <http://www.internetsociety.org/news/internet-technical-leaders-welcome-iana-globalization-progress>.
4. For more details on the Internet ecosystem and its participants, see <http://www.internetsociety.org/internet/who-makes-it-work>.
5. The working definition of Internet governance proposed by WGIG can be found in the WGIG Report. See: <http://www.wgig.org/WGIG-Report.html>.
6. ibid
7. See CGI website: <http://cgi.br>.
8. See <http://www.cgi.br/noticia/lei-do-marco-civil-da-internet-e-uma-grande-vitoria-para-os-brasileiros-considera-cgi-br/408>.
9. For more information on NETmundial, along with a link to the NETmundial Multistakeholder Statement, see <http://netmundial.br>. For reaction, see <http://www.internetsociety.org/blog/institutional/2014/04/netmundial-variations-theme-multistakeholder-consensus-building-action>.
10. See Kaspersky "Security Bulletin. Spam Evolution 2013": for more details. http://www.securelist.com/en/analysis/204792322/Kaspersky_Security_Bulletin_Spam_evolution_2013.
11. For more details on the Combating Spam Project, and links to further resources, see <http://www.internetsociety.org/what-we-do/policy/combating-spam-project>.
12. See <http://open-stand.org>.
13. See RFC 3935: <http://www.ietf.org/rfc/rfc3935.txt>.
14. See Daigle, L. 2013 "The Internet and OpenStand: The Internet Didn't Happen by Accident": http://www.circleid.com/posts/20131014_internet_and_openstand_the_internet_didnt_happen_by_accident.
15. For more information, see <http://www.opus-codec.org>.
16. RFC stands for 'Request for Comments' and refers to official publications of the IETF. See <http://tools.ietf.org/html/rfc6716>.
17. WebRTC (which stands for Web Real-Time Communication) is a set of protocols defined by the W3C to support browser-to-browser communications such as voice over IP without the use of plug-in software.
18. For more examples, see [http://en.wikipedia.org/wiki/Opus_\(audio_codec\)](http://en.wikipedia.org/wiki/Opus_(audio_codec)).
19. For more information, see <http://www.internetsociety.org/development>.
20. See <http://www.internetsociety.org/events/workshops/axis-project-and-axis-workshops>.
21. The process of sending domestic traffic outside the country to be exchanged and then routed back to the same country is sometimes known as 'tromboning'. For a review of the benefits of an IXP, see Kende, M. & Hurpy, C. 2012 "Assessment of the Impact of Internet Exchange Points – Empirical Study of Kenya and Nigeria", see <http://www.internetsociety.org/news/new-study-reveals-how-internet-exchange-points-ixps-spur-internet-growth-emerging-markets>.
22. See <http://www.internetsociety.org/news/internet-exchange-point-launched-7-march-2014-windhoek-namibia>, <http://www.internetsociety.org/news/internet-exchange-point-launched-21-march-2014-bujumbura-burundi>, and <http://www.internetsociety.org/news/internet-exchange-point-launched-10-april-2014-mbabane-kingdom-swaziland>
23. See <http://www.ixptoolkit.org>.
24. See <http://www.internetsociety.org/cisco-signs-three-year-commitment-internet-society-programs-including-interconnection-and-traffic>.
25. For further details, see <http://www.internetsociety.org/what-we-do/where-we-work/asia/south-asia/wireless-communities>.
26. See <https://www.facebook.com/chanderisaris>.

CHAPTER 3 - BENEFITS OF AN OPEN AND SUSTAINABLE INTERNET

1. Newspapers largely focus on their home markets, while radio and television requires spectrum to broadcast, which is licensed on a national level. As a result, traditional broadcast media content can typically only extend beyond borders through agreement between owners of the content in one country and owners of a mass medium in another.
2. See <http://ocw.mit.edu/index.htm>.
3. See OECD 2002, "Forum on the Impact of Open Courseware for Higher Education in Developing Countries": <http://unesdoc.unesco.org/images/0012/001285/128515e.pdf>.
4. For the announcement of the textbook repository, see <http://news.priyo.com/video/2011/04/24/pm-opens-online-version-textbo-24346.html>. The textbooks are made available by the National Curriculum and Textbook Board, at <http://www.nctb.gov.bd/downloadpage22.php>.
5. See the New York Times, 13 September 2013, "The Boy Genius of Ulan Bator": http://www.nytimes.com/2013/09/15/magazine/the-boy-genius-of-ulan-bator.html?_r=0.
6. See Van den Berg, D.J. 2013, "Why MOOCs Are Transforming the Face of Higher Education", http://www.huffingtonpost.co.uk/dirk-jan-van-den-berg/why-moocs-are-transforming_b_4116819.html
7. For further discussion of the digital divide between countries, see Section 4.
8. See Pew Research Center "Predicting the Future on the Web's 25th Anniversary", <http://www.pewinternet.org/2014/03/11/predicting-the-future-on-the-webs-25th-anniversary>.
9. See <http://www.google.com/elections/ed/us>.
10. See BBC News, "Italy's Five Star protest party makes waves", 5 December 2012, <http://www.bbc.com/news/world-europe-20643620>.
11. See <http://www.ustream.tv/recorded/29567161>.
12. See <http://www.beppegrillo.it>.
13. See, The Guardian 2013, "How Beppe Grillo's Social Media Politics took Italy by Storm": <http://www.theguardian.com/commentisfree/2013/feb/26/beppe-grillo-politics-social-media-italy>.
14. See Demos 2013, "New Political Actors in Europe: Beppe Grillo and the M5S", <http://www.demos.co.uk/publications/newpoliticalactorsineuropebeppegrilloandthem5s>.
15. However, both Bersani and Berlusconi were leading coalitions and therefore able to receive a greater proportion of the vote, M5S came third overall.
16. See Estonian National Electoral Committee, <http://www.vvk.ee/voting-methods-in-estonia/engindex/statistics>.
17. See <http://www.id.ee/?lang=en>.
18. Passenger rail services in the UK are franchised for a pre-defined period of time to train operating companies that purchase wholesale access to the tracks, run train services, and retail these services to end customers.
19. See "Reconsider West Coast Mainline franchise decision", <http://epetitions.direct.gov.uk/petitions/37180>.
20. See BBC News, "West Coast Main Line deal scrapped after contract flaws discovered," 3 October 2012, <http://www.bbc.com/news/business-19809717>.
21. See "We the People: Your Voice in our Government", <https://petitions.whitehouse.gov>.
22. See "A Comprehensive Approach to Wall Street Reform", <https://petitions.whitehouse.gov/response/comprehensive-approach-wall-street-reform>.
23. The White House released several beer recipes (featured ingredient: honey) in response to the petition. See <https://petitions.whitehouse.gov/petition/release-recipe-honey-ale-home-brewed-white-house/XkpkYwc0>.
24. According to the White House, "a Death Star isn't on the horizon." See <https://petitions.whitehouse.gov/petition/secure-resources-and-funding-and-begin-construction-death-star-2016/wlfKzFkN>.
25. See Kenya Revenue Authority, <http://www.revenue.go.ke>.
26. See Chancellor George Osborne's Autumn Statement 2013 speech, <https://www.gov.uk/government/speeches/chancellor-george-osbornes-autumn-statement-2013-speech>.
27. See The World Bank – Open Government Data Toolkit, <http://data.worldbank.org/open-government-data-toolkit>.
28. See <http://www.e-gov.waseda.ac.jp/ranking.htm>.
29. "Institute of e-Government released the 2013 World –Government Ranking," 26 March 2013, http://www.waseda.jp/eng/news12/130326_egov.html.
30. Singapore e-Gov, see <http://www.egov.gov.sg/home>.
31. See Infocomm Development Authority of Singapore, <http://www.ida.gov.sg/Business-Sectors/Overview>.
32. For instance, a change.org petition in the UK asked the BBC to reverse their decision to cancel Ripper Street, see <http://www.change.org/en-GB/petitions/reverse-the-bbc-s-decision-to-cancel-ripper-street>.
33. See The Guardian 2012, "Avaaz faces questions over role at centre of Syrian protest movement", <http://www.theguardian.com/world/2012/mar/02/avaaz-activist-group-syria>.
34. See <http://www.avaaz.org/en/about.php>.
35. See <http://www.change.org/en-GB/about>.

36. See Tell Bank of America: No \$5 Debit Card Fees, <http://www.change.org/petitions/tell-bank-of-america-no-5-debit-card-fees>.
37. See <http://www.ipaidabribe.com/bribe-trends>.
38. See <http://www.cchrcambodia.org>.
39. See <https://www.facebook.com/elshaheed.co.uk>.
40. See <http://googleblog.blogspot.co.uk/2011/01/some-weekend-work-that-will-hopefully.html>.
41. See the Government of Dubai, 2011, "Arab Social Media Report: Civil Movements: The Impact of Facebook and Twitter", <http://www.dsg.ae/en/publication/Description.aspx?PubID=236&PrimenuID=11&mnu=Pri&AspxAutoDetectCookieSupport=1>.
42. See eMarketer, 2013, "Ecommerce Sales Topped \$1 Trillion for First Time in 2012", <http://www.emarketer.com/Article/Ecommerce-Sales-Topped-1-Trillion-First-Time-2012/1009649>.
43. See Etsy 2013, "Redefining Entrepreneurship: EtsySellers' Economic Impact", <https://blog.etsy.com/news/2013/redefining-entrepreneurship-etsy-sellers-economic-impact>.
44. See <http://www.etsy.com/uk/press>.
45. McKinsey & Company, 2013 "Lions go digital: The Internet's transformative potential in Africa", see http://www.mckinsey.com/insights/high_tech_telecoms_internet/lions_go_digital_the_internets_transformative_potential_in_africa.
46. See <http://www.kayak.co.uk>.
47. See <http://en.wikipedia.org/wiki/Showrooming>.
48. See http://www.amazon.com/gp/feature.html?docId=aw_ppricecheck_iphone_mobile. An additional benefit of this app for Amazon is that it can build a database of retail pricing, which it can use to refine its own pricing.
49. Of course, trust violations occur, and often receive significant press, but not with a frequency that appears to impede the growth of the market. See Techcrunch 2014, "How Modern Marketplaces Like Uber and AirBnB Build Trust to Achieve Liquidity": <http://techcrunch.com/2014/03/04/how-modern-marketplaces-like-uber-and-airbnb-build-trust-to-achieve-liquidity>.
50. "State of the Least Developed Countries 2013", UN-OHRLLS 2013.
51. Ranked 168th in the category "Starting a Business" and 130th in "Getting Credit" out of 189 countries surveyed.
52. The Guardian, 14 December 2013 "Toxic 'e-waste' dumped in poor nations, says United Nations", <http://www.theguardian.com/global-development/2013/dec/14/toxic-ewaste-illegal-dumping-developing-countries>.
53. Fast Company 2013, "This African Inventor created a \$100 3-D Printer from E-waste", <http://www.fastcompany.com/3019880/this-african-inventor-created-a-100-3-d-printer-from-e-waste>.
54. See <https://2013.spaceappschallenge.org/project/wafate-to-mars>.
55. PC Advisor 2013, "The top 5 Kickstarter success stories: Oculus Rift, Pebble smart watch, Ouya and more", <http://www.pcadvisor.co.uk/features/internet/3471652/top-5-kickstarter-successes>.
56. "The Mozilla Manifesto", <https://www.mozilla.org/en-US/about/manifesto>.
57. See <https://github.com>.
58. A language of the Bantu family, native to parts of Namibia, Botswana, and Angola, and spoken by 240,000 people. See http://en.wikipedia.org/wiki/Herero_language.
59. See http://en.wikipedia.org/wiki/List_of_wikipedias.
60. See Wikimedia Report Card at <http://reportcard.wmflabs.org>.
61. See http://en.wikipedia.org/wiki/File:Wikimedia_projects_edits_counter_2010-04-16.png.
62. See <http://fold.it/portal>.
63. Unfortunately, these platforms also carry the potential to be misused for cyberbullying, or hacked, leading to significant negative consequences. See for example USA Today, 2013, "AP Twitter feed hacked; no attack at White House" <http://www.usatoday.com/story/theoval/2013/04/23/obama-carney-associated-press-hack-white-house/2106757/>.
64. See eMarketer, 2013, "US Total Media Ad Spend Inches Up, Pushed by Digital": <http://www.emarketer.com/Article/US-Total-Media-Ad-Spend-Inches-Up-Pushed-by-Digital/1010154>.
65. World Association of Newspaper and News Publishers, <http://www.wan-iffra.org>.
66. See Internet Live Stats, <http://www.internetlivestats.com/one-second>.
67. See <https://about.twitter.com/company>.
68. Business Insider, 2013, "Our List Of The World's Largest Social Networks Shows How Video, Messages, And China Are Taking Over the Social Web", see <http://www.businessinsider.com/the-worlds-largest-social-networks-2013-12>.
69. See Superdata 2013, "INFOGRAPHIC: Digital games year in review 2013" <http://www.superdataresearch.com/blog/infographic-digital-games-year-review-2013>.
70. See Superdata 2013, "Brazil online games market report" <http://www.superdataresearch.com/market-data/brazils-online-gaming-market>.
71. Forbes 2013, "Rovio Execs Explain What Angry Birds Toons Channel Opens Up To Its 1.7 Billion Gamers", see <http://www.forbes.com/sites/johngaudiosi/2013/03/11/rovio-execs-explain-what-angry-birds-toons-channel-opens-up-to-its-1-7-billion-gamers>.

72. See Bloomberg 2013, “‘Grand Theft Auto V’ Debut Expected to Reap \$1 Billion”, <http://www.bloomberg.com/news/2013-09-17/scuba-diving-thugs-to-reap-1-billion-with-grand-theft-.html>.
73. See <http://users.telenet.be/mmodata/Charts/Subs-1.png>.
74. See BBC 2007, “The high cost of playing Warcraft”, <http://news.bbc.co.uk/1/hi/technology/7007026.stm>.
75. IFPI 2013, “Digital Music Report 2013”; <http://www.ifpi.org/digital-music-report-2013.php>.
76. See <http://www.apple.com/choose-your-country>.
77. Apple Press Info 2013, “iTunes Store Sets New Record with 25 Billion Songs Sold”, <http://www.apple.com/uk/pr/library/2013/02/06iTunes-Store-Sets-New-Record-with-25-Billion-Songs-Sold.html>.
78. Youtube Official Blog 2013, “YouTube Rewind: What you watched in 2013”, <http://youtube-global.blogspot.se/2013/12/youtube-rewind-2013.html>.
79. Letter to shareholders, 21 April 2014, <http://files.shareholder.com/downloads/NFLX/3161131289x0x745654/fb5aaae0-b991-4e76-863c-3b859c8dece8/Q114%20Earnings%20Letter%204.21.14%20final.pdf>.
80. See Netflix Investor Relations: <http://ir.netflix.com/results.cfm>.
81. See The Wall Street Journal, 2013, “Netflix Makes Some History With Showing at Emmys”, <http://online.wsj.com/news/articles/SB10001424052702303759604579092061505560526>.
82. Los Angeles Times 2013, “Netflix and Disney’s Marvel strike blockbuster deal for new shows”, <http://www.latimes.com/entertainment/envelope/cotown/la-et-ct-netflix-marvel-disney-20131107,0,3396157.story#axzz2zi3JbTRS>.

CHAPTER 4 - CHALLENGES TO THE OPEN AND SUSTAINABLE INTERNET

1. Apple alone lists a total of 33 different physical keyboard localizations that it supplies with its personal computers, ranging from Arabic to Turkish. See <http://support.apple.com/kb/ht2841>. Further, Apple offers 60 virtual keyboards for touch-screen devices such as iPhones.
2. To power the computer, worldwide there are fourteen different plug types that must be adapted, electricity of eight different voltages that must be converted, and two different frequencies for which transformation is not possible unless the capability is built into the device (see <http://www.iec.ch/worldplugs/map.htm>). Of course, most computer adapters can accommodate different voltages and frequencies automatically, but the need to do so highlights the impact of not having a global standard.
3. On the fixed side, modems are different for DSL access over telephone lines, cable networks, or fibre networks, while on the mobile side, there are a jumble of different standards and frequencies for accessing mobile broadband, meaning that a mobile may need to be multi-band or multi-mode to work internationally. See <http://electronics.howstuffworks.com/cell-phone12.htm> for more details.
4. The costs of Internet access used here are either fixed or mobile broadband computer-based costs, see ITU 2013 “Measuring the Information Society”: <http://www.itu.int/pub/D-IND-ICTOI-2013>. We used the fixed or mobile broadband prices depending on availability and which is the cheapest in each country. In general the cheaper of the two prices is used, but where fixed broadband penetration (which is generally lower than mobile broadband penetration in developing countries) falls below 20% of households, the mobile broadband price is used, even where this is the higher of the two prices. The mobile broadband price is for 1GB of data accessed via a dongle that connects to a computer, rather than access for a mobile phone or tablet.
Analysing the prices of Internet access using only fixed or only mobile products would not significantly change the findings. For example, all fixed broadband prices available for Western Europe, North America, and developed Asia-Pacific fall below 2.5% of GDP per capita, while mobile prices for all but three countries in those same regions also fall below the 2.5% of GDP per capita line. These three countries are Cyprus, Greece, and the Netherlands, where mobile prices for 1GB of computer-based mobile-broadband data are 2.9%, 3.0%, and 3.6% of monthly GDP per capita respectively.
5. Note that these broadband prices do not control for the quality of the service provided, as measured for instance by maximum or average download bandwidth speeds. Instead, the affordability measure shows the affordability of broadband offers available to users in their country. Later in this section, we show differences in broadband speeds, which also serve to differentiate user experiences by country.
6. The Broadband Commission 2011, “Broadband Targets for 2015”, see http://www.broadbandcommission.org/Documents/Broadband_Targets.pdf.
7. The Broadband Commission 2013, “The State of Broadband 2013: Universalizing Broadband”, see <http://www.broadbandcommission.org/Documents/bb-annualreport2013.pdf>, pp 44-45.
8. M-Lab - Visualizations of Network Performance, see <http://www.measurementlab.net/visualizations>.
9. See Digital Agenda Scoreboard 2013, Belgium: Broadband Markets <https://ec.europa.eu/digital-agenda/sites/digital-agenda/files/BE%20-%20Broadband%20markets.pdf>.
10. See Australian Bureau of Statistics, Advertised Download Speed, <http://www.abs.gov.au/ausstats/abs@.nsf/Products/8153.0~June+2013~Chapter~Advertised+download+speed?OpenDocument>.
11. For population density data, see <http://www.tradingeconomics.com>.

12. See “The Coalition’s Plan For Fast Broadband and Affordable NBN”: <http://lpa.webcontent.s3.amazonaws.com/NBN/The%20Coalition%E2%80%99s%20Plan%20for%20Fast%20Broadband%20and%20an%20Affordable%20NBN.pdf>.
13. See for instance Kende, M & Schuman, R. 2013 “Lifting Barriers to Internet Development in Africa: Suggestions for Improving Connectivity”: <http://www.internetsociety.org/doc/lifting-barriers-internet-development-africa-suggestions-improving-connectivity>.
14. For further discussion of the opportunities and challenges of deploying an IXP, see also <http://www.ixptoolkit.org>.
15. See The Guardian 2011 “Georgian woman cuts off web access to whole of Armenia”: <http://www.theguardian.com/world/2011/apr/06/georgian-woman-cuts-web-access>.
16. Gigaom 2013, “Undersea cable cut near Egypt slows down Internet in Africa, Middle East, South Asia”, see <http://gigaom.com/2013/03/27/undersea-cable-cut-near-egypt-slows-down-internet-in-africa-middle-east-south-asia>.
17. See OpenNet Initiative, “Pulling the Plug: A Technical Review of the Internet Shutdown in Burma”, <https://opennet.net/research/bulletins/013>.
18. Renesys, 2012 “Syrian Internet Is Off The Air”: <http://www.renesys.com/2012/11/syria-off-the-air>.
19. Renesys 2011, “Egypt Leaves the Internet”, see <http://www.renesys.com/2011/01/egypt-leaves-the-internet>.
20. See Renesys, 2012, “Could It Happen In Your Country?” <http://www.renesys.com/2012/11/could-it-happen-in-your-countr>.
21. See <http://www2.ohchr.org/english/bodies/hrc/docs/gc34.pdf> at paragraph 15.
22. Paragraph 3 states that “Freedom of expression is a necessary condition for the realization of the principles of transparency and accountability that are, in turn, essential for the promotion and protection of human rights.” Id.
23. Id. at paragraph 43.
24. See <https://abena.crowdmap.com/main>.
25. See https://groups.google.com/forum/#!topic/crisiscommons/cqjic_InrtE.
26. See Song, S. 2014 “African Undersea Cables”, <http://manypossibilities.net/african-undersea-cables>.
27. See ITWeb Financial, 2011 “WACS to increase competition”, http://www.itweb.co.za/index.php?option=com_content&view=article&id=43079.
28. Netflix lists the speeds of six broadband providers, over which their customers are streaming video. See <http://ispspeedindex.netflix.com/costa-rica>.
29. See ITU ICTEYE, “Focus Areas – Regulatory Information”, at <https://www.itu.int/net4/itu-d/icteye/FocusAreas.aspx?paramWorkArea=TREG>.
30. See <http://www.freedomhouse.org/reports#.UtP0EbnuN9M>. Freedom House measures three aspects of Internet freedom: Obstacles to Access; Limits on Content; and Violations of User Rights. For purposes of this section, we focus on Limits on Content.
31. Low scores indicate high degrees of freedom with regard to content limits, i.e. filtering and blocking of websites, censorship and use of media for social and political activism.
32. See Agenzia delle Dogane e dei Monopoli (AAMS) <http://www.aams.gov.it/site.php?id=2484>.
33. See EDRi, 2011 “France: Loppsi 2 adopted – Internet filtering without court order”, <http://edri.org/edriagramnumber9-4web-blocking-adopted-france-loppsi-2>.
34. See <https://www.iwf.org.uk/about-iwf>.
35. See <http://www.theyworkforyou.com/wrans/?id=2008-06-16b.209620.h>; <https://www.iwf.org.uk/members/member-policies/url-list/iwf-list-recipients>.
36. See BBC, 2008 “Wikipedia child image censored”, <http://news.bbc.co.uk/1/hi/uk/7770456.stm>.
37. See http://en.wikipedia.org/wiki/Internet_Watch_Foundation_and_Wikipedia.
38. See The Sydney Morning Herald, 2009 “Dentist’s website on leaked blacklist”, <http://www.smh.com.au/national/dentists-website-on-leaked-blacklist-20090319-93cl.html>.
39. Bahrain Information Affairs Authority: <http://www.iaa.bh/policiesPressrules.aspx>.
40. See <http://www.herdict.org/explore/indepth?fc=BH>.
41. See <http://bahrainrights.org>.
42. YouTube, Facebook, Google+, and Twitter are among the international sites permanently blocked by China.
43. See China Digital Times, 2013 “Saying of the Week: China’s Internet is Open”: <http://chinadigitaltimes.net/2013/02/saying-of-the-week-chinas-internet-is-open>.
44. See CircleID, 2009 “China Blocks Twitter, Flickr, Bing, Hotmail, Windows Live, etc. Ahead of Tiananmen 20th Anniversary” http://www.circleid.com/posts/20090602_china_blocks_twitter_flickr_bing_hotmail_windows_live/
45. Yahoo News, 2011 “Myanmar authorities unblock some banned websites”, see <http://news.yahoo.com/myanmar-authorities-unblock-banned-websites-050311492.html>.
46. Live broadcasts are also available on BBC iPlayer, but consumers must purchase a UK TV license in order to watch these. However, this is only an additional cost for those consumers who do not own a TV set, since any household using a TV set is required to purchase a TV license whether or not they use the iPlayer service.

47. Available in Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, Switzerland, Australia, and Canada.
See <http://www.youtube.com/BBCiplayerglobal>.
48. See <http://iplayerhelp.external.bbc.co.uk/help/programmes/availableprogs>.
49. See YouTube 2013, "Netflix Quick Guide: Why Is Netflix Different in Each Country", <http://www.youtube.com/watch?v=LxnpqobGSzg&feature=youtu.be>.
50. See the blog "Netflix Canada vs USA" for more information <http://netflixcanadavsusa.blogspot.co.uk/2014/01/alphabetical-list-kmon-jan-13-2014.html#more>.
51. See <https://support.google.com/googleplay/answer/2843119?hl=en-GB>. We understand that content availability continues to expand, as more and more countries receive access to content, even since we gathered our data in January 2014.
52. With over 1.7 billion downloads of the game series by November 2013, see Section 3.
53. See http://europa.eu/rapid/press-release_CJE-11-102_en.htm.
54. Here Chinese refers to the Chinese language family, which includes Mandarin and Cantonese. See http://en.wikipedia.org/wiki/Chinese_language.
55. The American Standard Code for Information Interchange, a code for representing English characters as numbers, with each letter assigned a number from 0 to 127.
56. For more information on IDNs, see <http://www.icann.org/en/resources/idn>. For more on the IETF's Email Address Internationalization (EAI) see <http://datatracker.ietf.org/wg/eai>.
57. See <http://extranews.net>.
58. See http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/CI/CI/pdf/local_content_study.pdf.
59. Brian Muita, of Angani Limited, presented this at the Internet Society's African Peering and Interconnection Forum (AfPIF) in Casablanca, Morocco, 5 September 2013. See <http://www.internetsociety.org/doc/panel-session-role-research-innovation-and-entrepreneurship-brian-muita-angani>.
60. For further details, see Section 3.2.2 of the following paper: Kende, M. & Hurpy, C. 2012 "Assessment of the Impact of Internet Exchange Points – Empirical Study of Kenya and Nigeria", see <http://www.internetsociety.org/news/new-study-reveals-how-internet-exchange-points-ixps-spur-internet-growth-emerging-markets>.
61. According to RIPE:
RIPE Atlas is a global network of thousands of probes that measure Internet connectivity and reachability, providing an unprecedented understanding of the state of the Internet in real time. The entire Internet community can access the data collected by the network, as well as Internet maps, graphs and analyses based on the aggregated results. RIPE Atlas is coordinated by the RIPE NCC, one of five Regional Internet Registries (RIRs) that support the global operation of the Internet.
See <https://atlas.ripe.net>.
62. The probes were scheduled to provide a one-off ping measurement to www.youtube.com which was executed on 28 February 2014 at 05:17 UTC; 4,875 probes across 126 countries provided data. The probes were also scheduled to provide a one-off ping measurement to www.facebook.com on 24 April 2014 at 20:45 UTC; 5,257 probes across 136 countries provided data.
63. For more information on the operation and benefits of a cache, see http://en.wikipedia.org/wiki/Web_cache.
64. For more information on the GGC, see <https://peering.google.com/about/ggc.html>.
65. The Next Web, 2013 "Facebook opens its first data center outside the US, near the Arctic Circle in Luleå, Sweden": <http://thenextweb.com/facebook/2013/06/12/facebook-opens-its-first-data-center-outside-the-us-near-the-arctic-circle-in-lulea-sweden>.
66. See The Guardian 2013, "We cannot afford to be indifferent to Internet spying", <http://www.theguardian.com/technology/2013/dec/09/internet-surveillance-spying>.
67. See BBC, 2013 "Edward Snowden leaks: NSA 'debates' amnesty", <http://www.bbc.co.uk/news/world-us-canada-25399345>.
68. See interview with Glenn Greenwald, GQ, May 2014, "The Man Who Knows Too Much", <http://www.gq.com/news-politics/newsmakers/201406/glenn-greenwald-edward-snowden-no-place-to-hide>.
69. See The New York Times, 2014 "Revelations of N.S.A. Spying Cost U.S. Tech Companies", <http://www.nytimes.com/2014/03/22/business/fallout-from-snowden-hurting-bottom-line-of-tech-companies.html>.
70. See Financial Times, 2014 "Microsoft to shield foreign users' data", <http://www.ft.com/cms/s/0/e14ddf70-8390-11e3-aa65-00144feab7de.html#axzz2ri2Hk2sM>.
71. See The Huffington Post, 2013, "Marco Civil: Brazil's Push to Govern the Internet", http://www.huffingtonpost.com/t-a-ridout/brazils-push-to-govern-the-internet_b_4133811.html.
72. See Bloomberg, 2014 "Brazil House Passes Internet Bill as Data Demand Dropped", <http://www.bloomberg.com/news/2014-03-26/brazil-house-passes-internet-bill-as-data-demand-dropped.html>.
73. See Reuters, 2013 "Brazil's anti-spying Internet push could backfire, industry says". See <http://www.reuters.com/article/2013/10/02/us-brazil-internet-idUSBRE9910F120131002>
74. See http://en.wikipedia.org/wiki/Beggar_thy_neighbour.

Internet Society

A global, cause-driven organization, the Internet Society is a leading advocate for the ongoing development of the Internet as an open platform that serves the social, economic, and educational needs of people throughout the world.

Founded in 1992 by several Internet pioneers, the Internet Society works in the areas of technology, policy, and development to promote an open, accessible Internet for everyone. A shared vision of keeping the Internet open unites the 60,000 individuals, more than 100 Chapters, and more than 150 Organizations around the world that are members of the Internet Society. Together, we represent a worldwide network focused on identifying and addressing the challenges and opportunities that exist online today and in the years ahead.

To achieve our mission, the Internet Society:

- Champions public policies that support a free and open Internet;
- Facilitates the open development of Internet standards and protocols to allow everyone to connect to everything on line;
- Offers discussion forums on issues that affect Internet evolution, development, and use in technical, commercial, societal, and other contexts;
- Works globally on Internet issues, leveraging Regional Bureaus and Chapters for collaboration and engagement that strengthens our impact and relevance at the local level; and
- Promotes professional development and builds community to foster participation and leadership in areas important to the Internet's evolution.

For more information, visit www.internetsociety.org

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**Exhibit E: The Zettabyte Era—Trends and
Analysis—Cisco**

Visual Networking Index (VNI)

The Zettabyte Era—Trends and Analysis

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June 10, 2014

This document is part of the Cisco® Visual Networking Index (VNI), an ongoing initiative to track and forecast the impact of visual networking applications. The document presents some of the main findings of Cisco's global IP traffic forecast and explores the implications of IP traffic growth for service providers. For a more detailed look at the forecast and the methodology behind it, visit [Cisco VNI: Forecast and Methodology](#).

Executive Summary

Annual global IP traffic will pass the zettabyte (1000 exabytes) threshold by the end of 2016, and will reach 1.6 zettabytes per year by 2018. In 2016, global IP traffic will reach 1.1 zettabytes per year or 91.3 exabytes (one billion gigabytes) per month, and by 2018, global IP traffic will reach 1.6 zettabytes per year or 131.9 exabytes per month.

Global IP traffic has increased fivefold over the past 5 years, and will increase threefold over the next 5 years. Overall, IP traffic will grow at a compound annual growth rate (CAGR) of 21 percent from 2013 to 2018.

Busy-hour Internet traffic is growing more rapidly than average Internet traffic. Busy-hour (or the busiest 60-minute period in a day) Internet traffic increased 32 percent in 2013, compared with 25 percent growth in average traffic. Busy-hour Internet traffic will increase by a factor of 3.4 between 2013 and 2018, while average Internet traffic will increase 2.8-fold. Busy-hour Internet traffic will reach 1.0 petabits per second (Pbps) in 2018, while average Internet traffic will reach 311 terabits per second.

Metro traffic will surpass long-haul traffic in 2015, and will account for 62 percent of total IP traffic by 2018. Metro traffic will grow nearly twice as fast as long-haul traffic from 2013 to 2018. The higher growth in metro networks is due in part to the increasingly significant role of content delivery networks, which bypass long-haul links and deliver traffic to metro and regional backbones.

Content delivery networks will carry more than half of Internet traffic by 2018. Fifty-five percent of all Internet traffic will cross content delivery networks by 2018 globally, up from 36 percent in 2013.

Over half of all IP traffic will originate with non-PC devices by 2018. In 2013, only 33 percent of total IP traffic originated with non-PC devices, but by 2018 the non-PC share of total IP traffic will grow to 57 percent. PC-originated traffic will grow at a CAGR of 10 percent, while TVs, tablets, smartphones, and machine-to-machine (M2M) modules will have traffic growth rates of 35 percent, 74 percent, 64 percent, and 84 percent, respectively.

Traffic from wireless and mobile devices will exceed traffic from wired devices by 2016. By 2016, wired devices will account for 46 percent of IP traffic, while Wi-Fi and mobile devices will account for 54 percent of IP traffic. In 2013, wired devices accounted for the majority of IP traffic at 56 percent.

Global Internet traffic in 2018 will be equivalent to 64 times the volume of the entire global Internet in 2005. Globally, Internet traffic will reach 14 gigabytes (GB) per capita by 2018, up from 5 GB per capita in 2013.

The number of devices connected to IP networks will be nearly twice as high as the global population by 2018. There will be nearly three networked devices per capita by 2018, up from nearly two networked devices per capita in 2013. Accelerated in part by the increase in devices and the capabilities of those

devices, IP traffic per capita will reach 17 GB per capita by 2018, up from 7 GB per capita in 2013.

Broadband speeds will nearly triple by 2018. By 2018, global fixed broadband speeds will reach 42 Mbps, up from 16 Mbps in 2013.

Global Internet Video Highlights

It would take an individual more than 5 million years to watch the amount of video that will cross global IP networks each month in 2018. Every second, nearly a million minutes of video content will cross the network by 2018.

Globally, IP video traffic will be 79 percent of all IP traffic (both business and consumer) by 2018, up from 66 percent in 2013. This percentage does not include the amount of video exchanged through peer-to-peer (P2P) file sharing. The sum of all forms of video (TV, video on demand [VoD], Internet, and P2P) will continue to be in the range of 80 to 90 percent of global consumer traffic by 2018.

Internet video to TV grew 35 percent in 2013. It will continue to grow at a rapid pace, increasing fourfold by 2018. Internet video to TV will be 14 percent of consumer Internet video traffic in 2018, up from 11 percent in 2013.

Consumer VoD traffic will double by 2018. The amount of VoD traffic in 2018 will be equivalent to 6 billion DVDs per month.

Content delivery network traffic will deliver over half of all Internet video traffic by 2018. By 2018, 67 percent of all Internet video traffic will cross content delivery networks, up from 53 percent in 2013.

Global Mobile Highlights

Globally, mobile data traffic will increase 11-fold between 2013 and 2018. Mobile data traffic will grow at a CAGR of 61 percent between 2013 and 2018, reaching 15.9 exabytes per month by 2018.

Global mobile data traffic will grow three times faster than fixed IP traffic from 2013 to 2018. Global mobile data traffic was 3 percent of total IP traffic in 2013, and will be 12 percent of total IP traffic by 2018.

Regional Highlights

IP traffic is growing fastest in the Middle East and Africa, followed by Asia Pacific. Traffic in the Middle East and Africa will grow at a CAGR of 38 percent between 2013 and 2018.

Summary of regional growth rates:

- IP traffic in North America will reach 40.5 exabytes per month by 2018 at a CAGR of 20 percent.
- IP traffic in Western Europe will reach 19.3 exabytes per month by 2018 at a CAGR of 18 percent.

- IP traffic in Asia Pacific will reach 47.3 exabytes per month by 2018 at a CAGR of 21 percent.
- IP traffic in Latin America will reach 8.9 exabytes per month by 2018 at a CAGR of 21 percent.
- IP traffic in Central and Eastern Europe will reach 10.2 exabytes per month by 2018 at a CAGR of 23 percent.
- IP traffic in the Middle East and Africa will reach 5.3 exabytes per month by 2018 at a CAGR of 38 percent.

Note: Several interactive tools are available to allow you to create custom highlights and forecast charts by region, by country, by application, and by end-user segment (refer to the [Cisco VNI Forecast Highlights tool](#) and the [Cisco VNI Forecast Widget tool](#)).

Global Business Highlights

Business IP traffic will grow at a CAGR of 18 percent from 2013 to 2018.

Increased adoption of advanced video communications in the enterprise segment will cause business IP traffic to grow by a factor of two between 2013 and 2018.

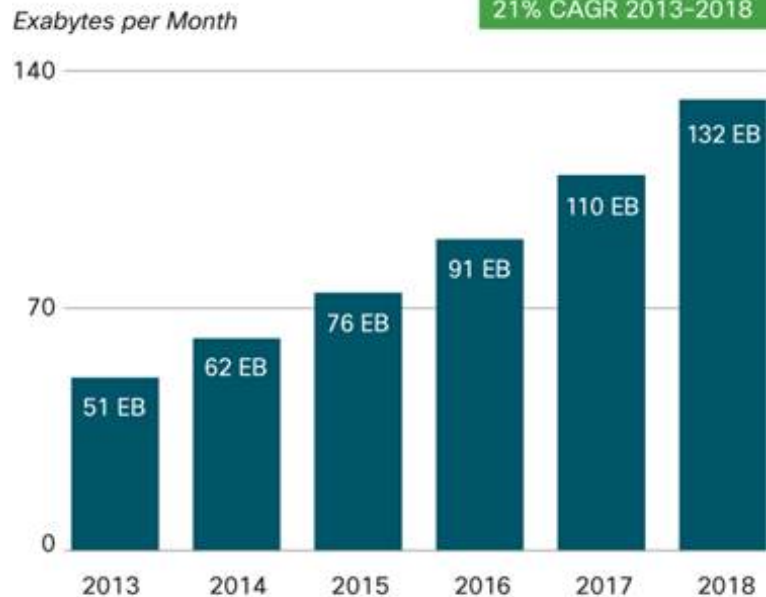
Business Internet traffic will grow at a faster pace than IP WAN. IP WAN will grow at a CAGR of 10 percent, compared with a CAGR of 18 percent for fixed business Internet and 55 percent for mobile business Internet.

Business IP traffic will grow fastest in the Middle East and Africa. Business IP traffic in the Middle East and Africa will grow at a CAGR of 23 percent, a faster pace than the global average of 18 percent. In volume, Asia Pacific will have the largest amount of business IP traffic in 2018 at 8.5 exabytes per month. North America will be the second at 6.2 exabytes per month.

Forecast Overview

The current Visual Networking Index forecast projects global IP traffic to nearly triple from 2013 to 2018. See Appendix A for a detailed summary. Overall IP traffic is expected to grow to 132 exabytes per month by 2018, up from 51 exabytes per month in 2013, a CAGR of 21 percent (Figure 1).

Figure 1. Cisco VNI Forecasts 132 Exabytes per Month of IP Traffic by 2018



Source: Cisco VNI, 2014

For more details about Cisco’s forecasting methodology, refer to the paper entitled “Cisco VNI: Forecast and Methodology, 2013–2018.”

To appreciate the magnitude of IP traffic volumes, it helps to put the numbers in more familiar terms:

- By 2018, the gigabyte equivalent of all movies ever made will cross the global Internet every 3 minutes.
- Globally, IP traffic will reach 400 terabits per second (Tbps) in 2018, the equivalent of 148 million people streaming Internet HD video simultaneously, all day, every day.
- Global IP traffic in 2018 will be equivalent to 395 billion DVDs per year, 33 billion DVDs per month, or 45 million DVDs per hour.

Total Internet traffic has experienced dramatic growth the past two decades. More than twenty years ago, in 1992, global Internet networks carried approximately 100 GB of traffic per day. Ten years later, in 2002, global Internet traffic amounted to 100 gigabytes per second (GBps). In 2012, global Internet traffic reached 12,000 GBps. Table 1 provides a view of the historical benchmarks for total Internet traffic.

Table 1. The Cisco VNI Forecast Within Historical Context

Year	Global Internet Traffic
1992	100 GB per Day

1997	100 GB per Hour
2002	100 GBps
2007	2000 GBps
2013	28,875 GBps
2018	50,000 GBps

Source: Cisco VNI, 2014

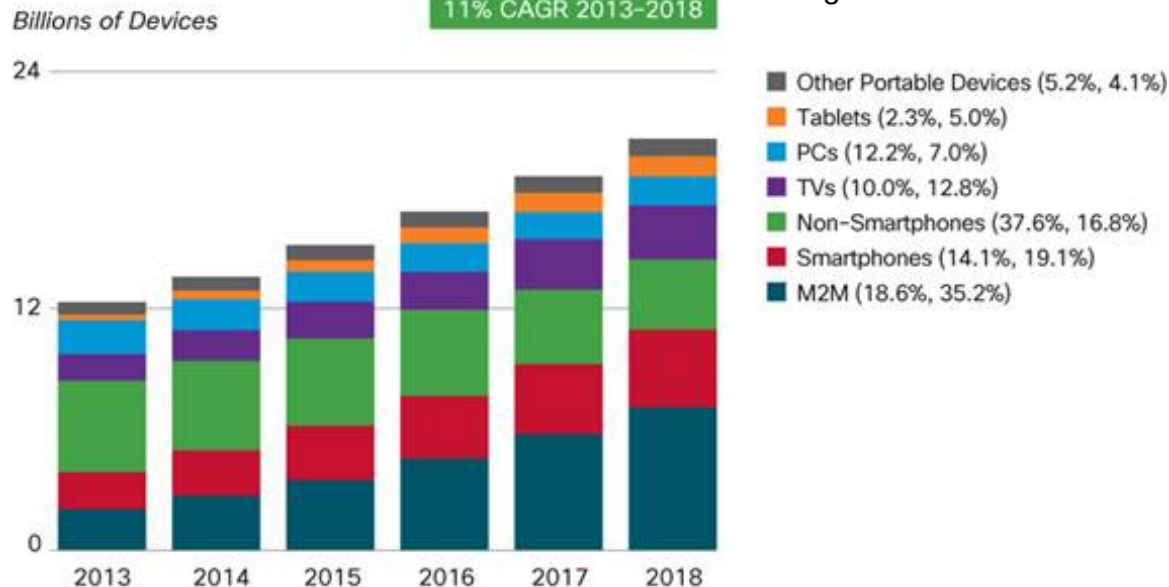
Per capita IP and Internet traffic growth has followed a similarly steep growth curve over the past decade. Globally, IP traffic will reach 17 GB per capita by 2018, up from 7 GB per capita in 2013, and Internet traffic will reach 14 GB per capita by 2018, up from 5 GB per capita in 2013. Not long ago, in 2008, per capita Internet traffic was 1 GB per month. In 2000, per capita Internet traffic was 10 megabytes (MB) per month.

The sections that follow explore the trends contributing to the continued growth of global IP traffic.

Trend 1: Device Transitions Alter Network Demand or Use

Globally, devices and connections (10.7 percent CAGR) are growing faster than both the population (1.1 percent CAGR) and Internet users (9.2 percent CAGR). See Figure 2. This trend is accelerating the increase in the average number of devices and connections per household and per Internet user. Each year, various new devices in different form factors with increased capabilities and intelligence are introduced and adopted in the market. A growing number of M2M applications, such as smart meters, video surveillance, healthcare monitoring, transportation, and package or asset tracking, also are causing connection growth.

Figure 2. Global Devices and Connections Growth



Source: Cisco VNI, 2014

The percentages in parentheses next to the legend denote the device share for the years 2013 and 2018, respectively.

Tablets are the fastest-growing device category with 29 percent CAGR (3.6-fold growth) over the forecast period, followed by machine-to-machine (M2M) connections with 26 percent CAGR (threefold growth). Device categories such as non-smartphones are actually going to start seeing a decline over the forecast period, increasingly being replaced by smartphones, which will more than double at 18 percent CAGR over the forecast period. Connected TVs, which includes flat-panel TVs, set-top boxes, digital media adapters, Blu-ray disc players, and gaming consoles) will double to 2.6 billion by 2018. PCs will also decline by 1 percent CAGR over the forecast period. This decline is more pronounced in Western Europe and North America. More tablets than laptops will be in use by the end of 2018.

Consumer share of the total devices, including the fixed and the mobile, is going to be about 80 percent, with business claiming the remaining 20 percent. Consumer share is going to grow slightly faster, at an 11 percent CAGR relative to the business segment, which is going to grow at a 9 percent CAGR. For more details about devices and connections growth by residential, consumer mobile, and business segments, refer to the [Cisco VNI Service Adoption Forecast, 2013–2018](#).

Globally, the average number of devices and connections per capita is going to grow from 1.7 in 2013 to 2.7 by 2018 (Table 2).

Table 2. Average Number of Devices and Connections per Capita

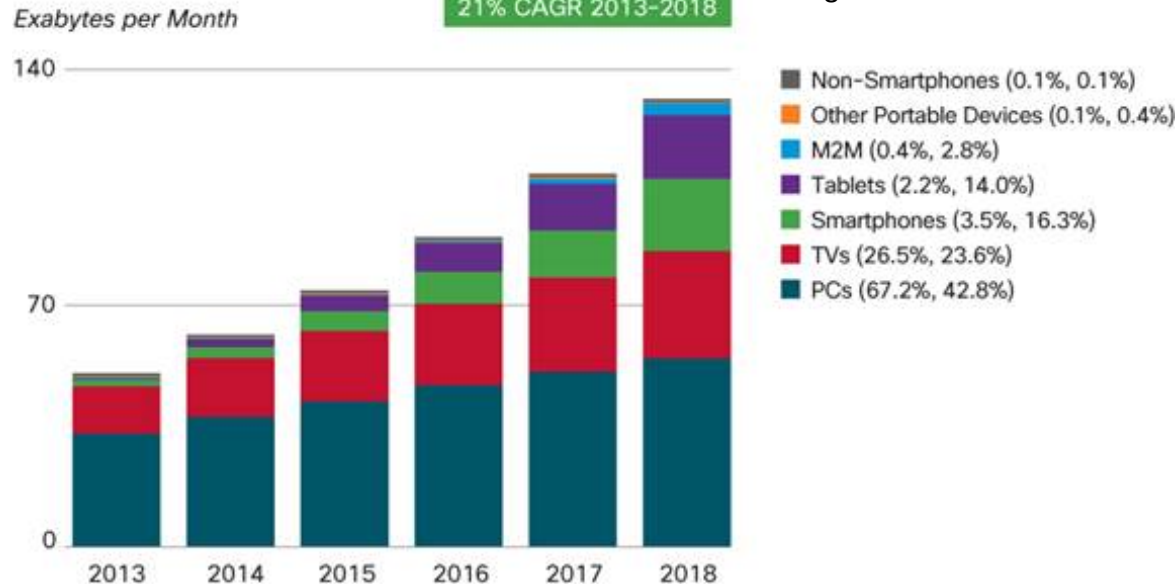
	2013	2018	CAGR

Asia Pacific	1.41	2.24	9.7%
Central and Eastern Europe	2.10	3.39	10.1%
Latin America	1.75	2.58	8.1%
Middle East and Africa	0.92	1.28	6.7%
North America	5.34	9.26	11.7%
Western Europe	3.89	6.52	10.9%
Global	1.73	2.73	9.5%

Source: Cisco VNI, 2014

The changing mix of devices and connections and growth in multidevice ownership affects traffic and can be seen in the changing device contribution to total IP traffic. At the end of 2013, 33 percent of IP traffic and 15 percent of consumer Internet traffic originated from non-PC devices. By 2018, 57 percent of IP traffic and 52 percent of consumer Internet traffic will originate from non-PC devices (Figure 3).

Figure 3. Global IP Traffic by Devices

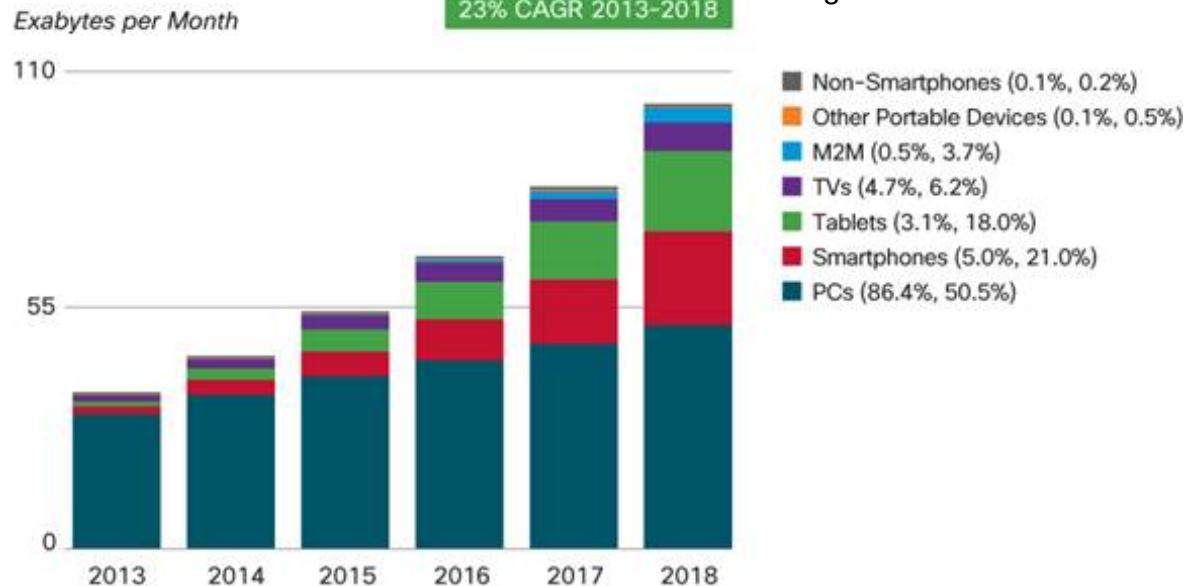


Source: Cisco VNI, 2014

The percentages in parentheses next to the legend denote the device traffic shares for the years 2013 and 2018, respectively.

As in the case of mobile networks, video devices can have a multiplier effect on traffic. An Internet-enabled HD television that draws 50 minutes of content per day from the Internet would generate as much Internet traffic as an entire household today. With the growth of video viewing on tablets, traffic from tablets is growing as a percentage of total internet traffic. Tablets will account for 18 percent of total global internet traffic by 2018, up from 3 percent in 2013 (Figure 4).

Figure 4. Global Internet Traffic by Device Type

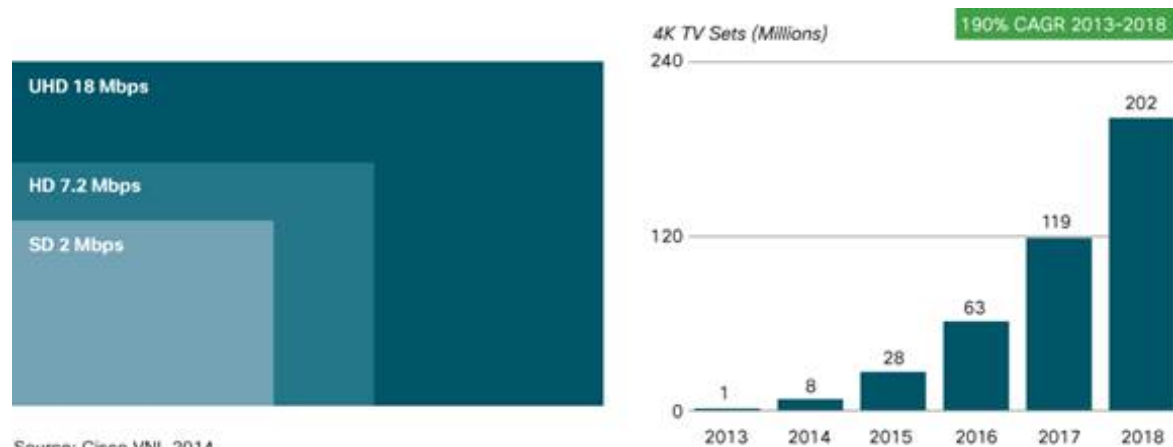


Source: Cisco VNI, 2014

The percentages in parentheses next to the legend denote the device traffic shares for the years 2013 and 2018, respectively.

The video impact of the devices on the traffic is more pronounced due to the introduction of ultra-high-definition (UHD) or 4K video streaming. This is because the bit rate for 4K video at about 18 Mbps is more than double the HD video bit rate and nine times more than standard-definition (SD) video bit rate. We estimate that by 2018, 21 percent of the installed flat-panel TV sets will be UHD, up from 0.4 percent in 2013 (Figure 5).

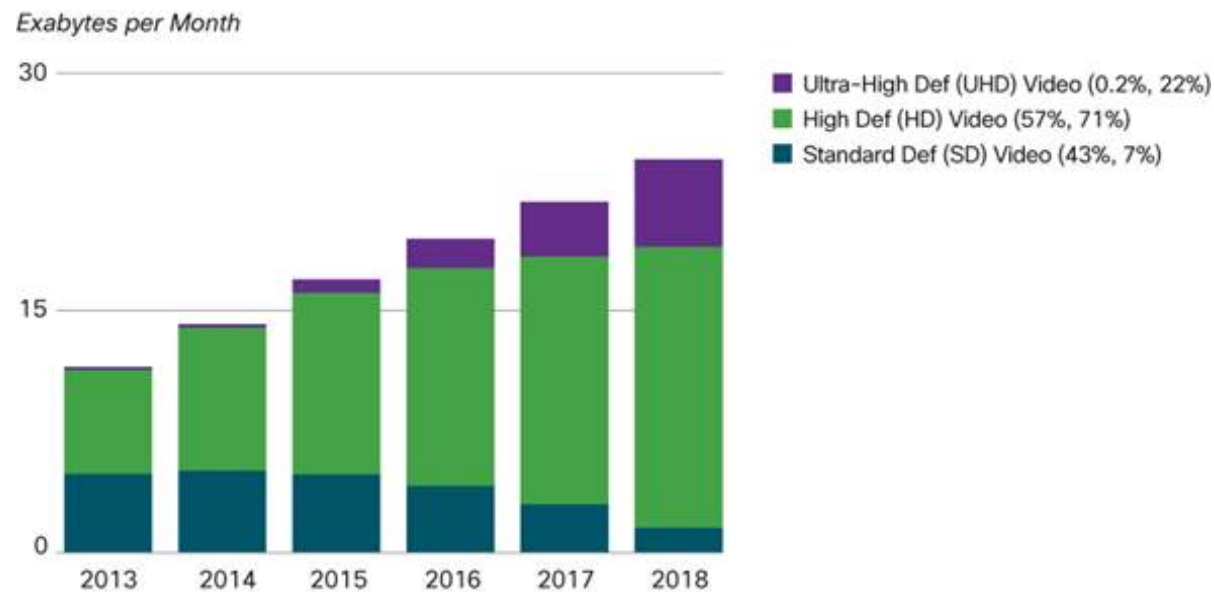
Figure 5. Increasing Video Definition: By 2018, More than 20 Percent of Connected Flat-Panel TV Sets Will Be 4K



Source: Cisco VNI, 2014

Ultra-HD (or 4K) IP VOD Will Account for 22% of global VOD Traffic in 2018, per

Figure 6.

Figure 6. 4K Video Traffic

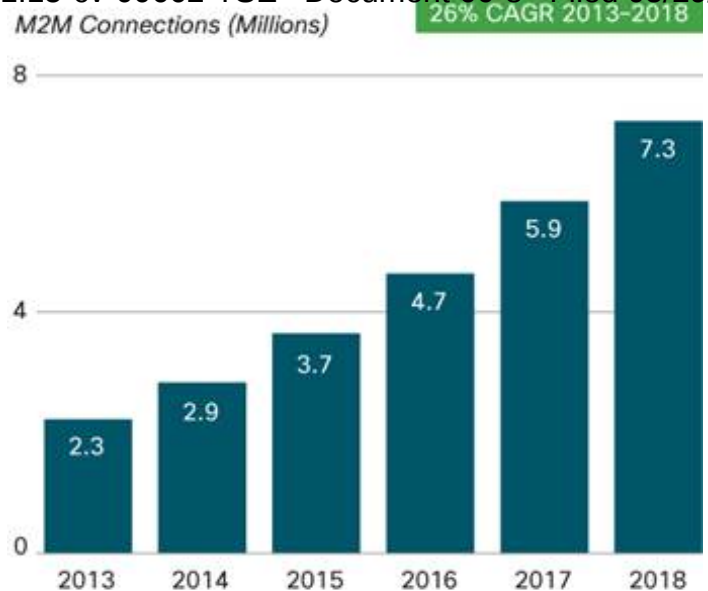
Source: Cisco VNI, 2014

The percentages next to the legend denote the traffic share for the years 2013 and 2018 respectively.

Trend 2: M2M Growth Drives the Reality of Internet of Everything

The Internet of Everything (IoE) phenomenon, or the next wave of the Internet in which people, processes, data, and things connect to the Internet and each other, is showing tangible growth. Globally, M2M connections will grow threefold from 2.3 billion in 2013 to 7.3 billion by 2018 (Figure 7). There will be nearly one M2M connection for each member of the global population by 2018.

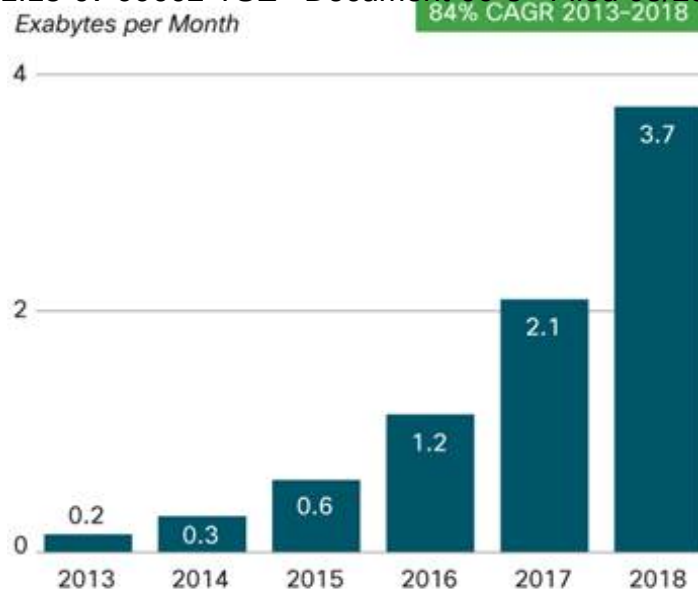
Figure 7. M2M Growth



Source: Cisco VNI, 2014

Applications such as video surveillance, smart meters, smart cars, asset and package tracking, chipped pets and livestock, digital health monitors, and a host of other next-generation M2M services are driving this growth.

Figure 8. M2M Traffic Growth



Source: Cisco VNI, 2014

While the number of connections is growing threefold, global M2M IP traffic will grow 11-fold over this same period, from 179 petabytes in 2013 (0.4 percent of global IP traffic) to 3.7 exabytes by 2018 (2.8 percent of global IP traffic). See Figure 8. The higher traffic growth than connections growth is due to more video applications being deployed on M2M connections as well as the use of applications, such as telemedicine and smart car navigation, that require higher bandwidth and lower latency.

Trend 3: Fixed Broadband Speeds Will Nearly Triple by 2018

Fixed Speeds

Broadband speed is a crucial enabler of IP traffic. Broadband speed improvements result in increased consumption and use of high-bandwidth content and applications. The global average broadband speed continues to grow and will nearly triple from 2013 to 2018, from 16.1 Mbps to 42.2 Mbps. Table 3 shows the projected broadband speeds from 2013 to 2018. Several factors influence the fixed broadband speed forecast, including the deployment and adoption of fiber to the home (FTTH), high-speed DSL, and cable broadband adoption, as well as overall broadband penetration. Among the countries covered by this study, Japan, South Korea, and Sweden lead in terms of broadband speed largely because of their wide deployment of FTTH.

Table 3. Fixed Broadband Speeds, Mbps, 2013–2018

Region	2013	2014	2015	2016	2017	2018	CAGR

Global	11.3	16.1	20.3	25.8	31.1	38.7	42.9
Asia Pacific	10.4	18.0	23.2	29.7	36.4	42.5	48.1
Latin America	5.4	6.4	7.8	9.6	11.6	13.9	16.4
North America	12.9	17.6	21.8	27.0	32.3	37.7	43.2
Western Europe	13.0	19.3	23.8	29.3	35.4	42.1	48.9
Central and Eastern Europe	12.3	17.5	22.2	28.3	34.6	40.0	45.3
Middle East and Africa	2.5	5.7	7.1	8.8	10.8	12.8	14.9

Source: Cisco VNI, 2014

Consider how long it takes to download aHD movie at these speeds: at 5 Mbps, it takes 41minutes to download the movie; at10 Mbps, it takes 20 minutes; but at 100 Mbps, it takes only 2minutes. High-bandwidth speeds will bean essential support for consumer cloud storage, making the download of large multimedia files as fast as a transfer from a hard drive. Table 4 shows the percentage of broadband connections that will be faster than 5 Mbps, 10 Mbps, and 100 Mbps by region.

Table 4. Broadband Speed Greater than 10 Mbps, 2013–2018

Region	Greater than 10 Mbps		Greater than 50 Mbps		Greater than 100 Mbps	
	2013	2018	2013	2018	2013	2018
Global	45%	55%	12%	22%	2%	3%
Asia Pacific	43%	53%	13%	23%	2%	4%

Latin America	24%	34%	3%	3%	1%	2%
North America	57%	62%	12%	20%	2%	4%
Western Europe	50%	52%	14%	24%	4%	6%
Central and Eastern Europe	47%	73%	12%	25%	1%	3%
Middle East and Africa	18%	23%	2%	4%	0.3%	1%

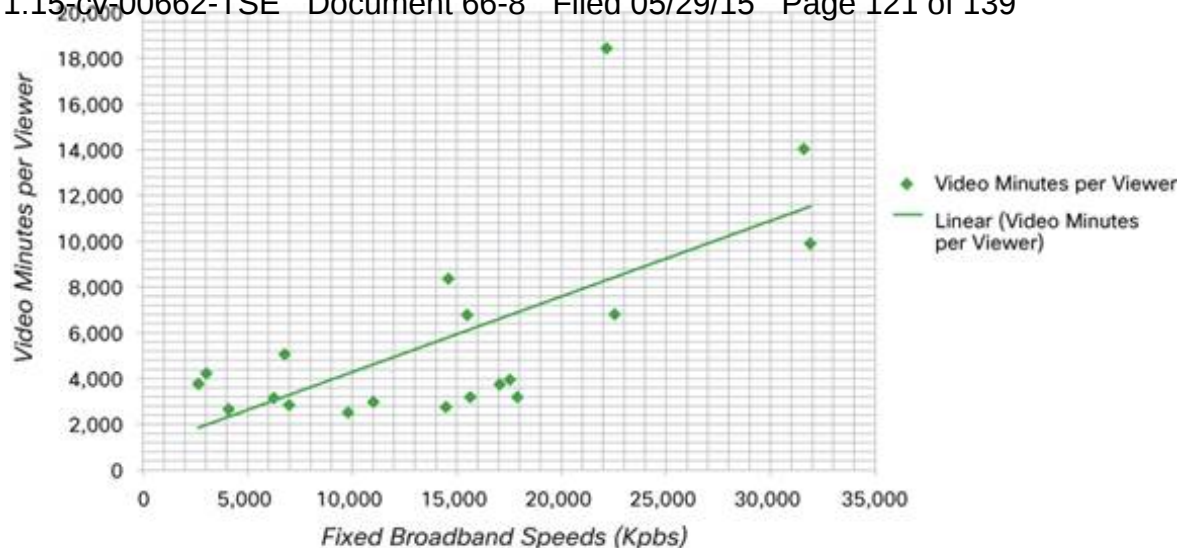
Source: Cisco VNI, 2014

Mobile Speeds

Globally, the average mobile network connection speed in 2013 was 1.4 Mbps. The average speed will nearly double, and will exceed 2.5 Mbps by 2018. Smartphone speeds, generally third-generation (3G) and higher, are currently almost three times higher than the overall average. Smartphone speeds will nearly double by 2018, reaching 7.0 Mbps.

There is a strong correlation between experienced speeds and number of video minutes viewed per viewer (Figure 9). As speeds increase in each country covered in the study, the number of video minutes per viewer also increases.

Figure 9. Increase in Experienced Speeds (Kbps) Increases Internet Video Viewership (Minutes)



Source: Cisco VNI, 2014

Anecdotal evidence supports the idea that overall usage increases when speed increases, although there is often a delay between the increase in speed and the increased usage, which can range from a few months to several years. The reverse can also be true with the burstiness associated with the adoption of tablets and smartphones, where there is a delay in experiencing the speeds that the devices are capable of supporting. The Cisco VNI Forecast relates application bit rates to the average speeds in each country. Many of the trends in the resulting traffic forecast can be seen in the speed forecast, such as the high growth rates for developing countries and regions relative to more developed areas (Table 5).

Table 5. Projected Average Mobile Network Connection Speeds (in Kbps) by Region and Country

	2013	2014	2015	2016	2017	2018	CAGR 2013–2018
Global							
Global speed: All handsets	1,387	1,676	1,908	2,147	2,396	2,509	13%
Global speed: Smartphones	3,983	4,864	5,504	6,132	6,756	7,044	12%

Global speed: Tablets	4,391	5,584	6,298	6,483	8,018	8,998	14%
By Region							
Asia Pacific	1,327	1,492	1,617	1,728	1,863	1,992	8%
Latin America	684	734	793	856	924	999	8%
North America	1,728	2,010	2,304	2,620	2,988	4,549	21%
Western Europe	1,585	1,735	1,946	2,183	2,452	3,003	14%
Central and Eastern Europe	1,351	1,446	1,711	1,945	2,128	2,269	11%
Middle East and Africa	529	605	675	753	832	900	11%

Source: Cisco VNI Mobile, 2014

Current and historical speeds are based on data from the Cisco Global Internet Speed Test (GIST) application and Ookla's Speedtest. Forward projections for mobile data speeds are based on third-party forecasts for the relative proportions of 2G, 3G, 3.5G, and 4G among mobile connections through 2018. For more information about Cisco GIST, visit <http://gistdata.ciscovni.com/>.

A crucial factor promoting the increase in mobile speeds over the forecast period is the increasing proportion of fourth-generation (4G) mobile connections. The impact of 4G connections on traffic is significant, because 4G connections, which include mobile WiMAX and Long-Term Evolution (LTE), generate a disproportionate amount of mobile data traffic.

Wi-Fi Speeds from Mobile Devices

Globally, Wi-Fi connection speeds originated from dual-mode mobile devices will more than double by 2018. The average Wi-Fi network connection speed (9.9 Mbps in 2013) will exceed 21 Mbps in 2018. North America will experience the highest Wi-Fi speeds of 22.6 Mbps by 2018, and Central and Eastern Europe will have the highest growth by 2018 with Wi-Fi speeds increasing 17 percent over the forecast period (Table 6).

Wi-Fi speeds inherently depend on the quality of the broadband connection to the premises. Also dependent on the speeds is the Wi-Fi standard in the

customer-premises-equipment (CPE) device. The latest standard, 802.11ac, is considered a true wired complement and can enable higher-definition video streaming and services that require higher data rates. Also a key factor in the usage of the Wi-Fi technology is the number and availability of hotspots. Globally, there will be nearly 53 million hotspots by 2018, up from 22 million hotspots in 2013, a fourfold increase. The Asia Pacific region will have the highest number of hotspots by 2018.

Table 6. Projected Average Wi-Fi Network Connection Speeds (in Mbps) by Region and Country

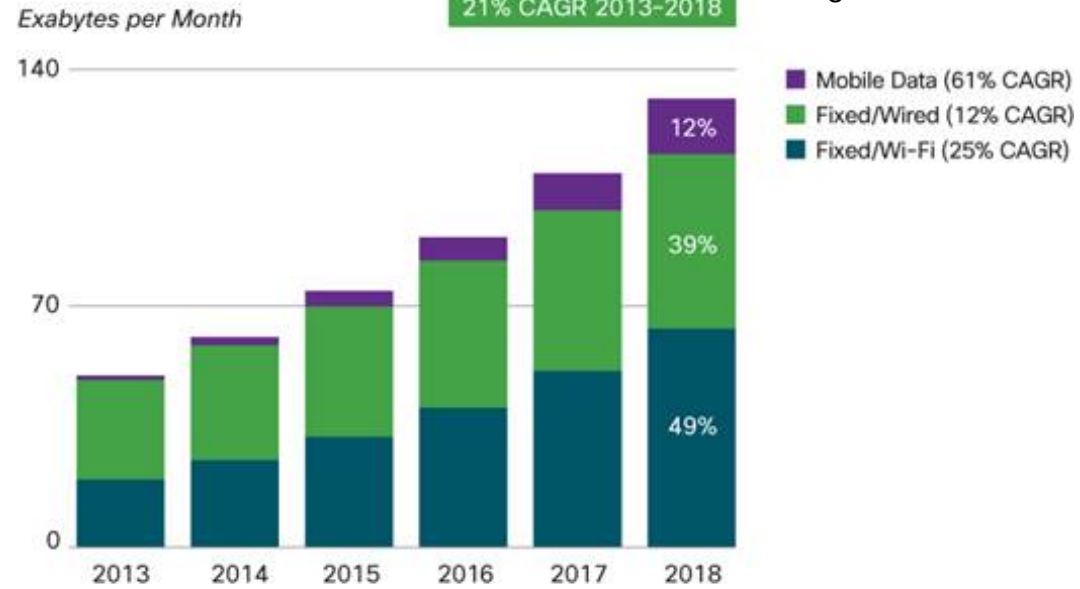
Region	2013	2014	2015	2016	2017	2018	CAGR
Global	9.9	12.6	14.9	17.3	19.3	21.4	16%
Asia Pacific	10.3	13.3	15.8	18.2	20.1	21.9	16%
Latin America	4.7	5.8	6.6	7.5	8.4	9.6	15%
North America	11.6	14.3	16.5	18.5	20.6	22.6	14%
Western Europe	10.6	13.0	14.9	16.9	19.1	21.4	15%
Central and Eastern Europe	9.2	11.7	14.1	16.3	18.5	20.6	17%
Middle East and Africa	4.0	4.9	5.7	6.6	7.4	8.4	16%

Source: Cisco VNI, 2014

Trend 4: Wi-Fi Dominates Access Technology

The rapid growth of mobile data traffic has been widely recognized and reported. The trend toward mobility carries over into the realm of fixed networks as well, in that an increasing portion of traffic will originate from portable or mobile devices. Figure 10 shows the growth of Wi-Fi and mobile traffic in relation to traffic from wired devices. By 2018, wired networks will account for 39 percent of IP traffic, while Wi-Fi and mobile networks will account for 61 percent of IP traffic. In 2013, wired networks accounted for the majority of IP traffic at 56 percent, Wi-Fi accounted for 41 percent, and mobile or cellular networks accounted for 3 percent of total global IP traffic.

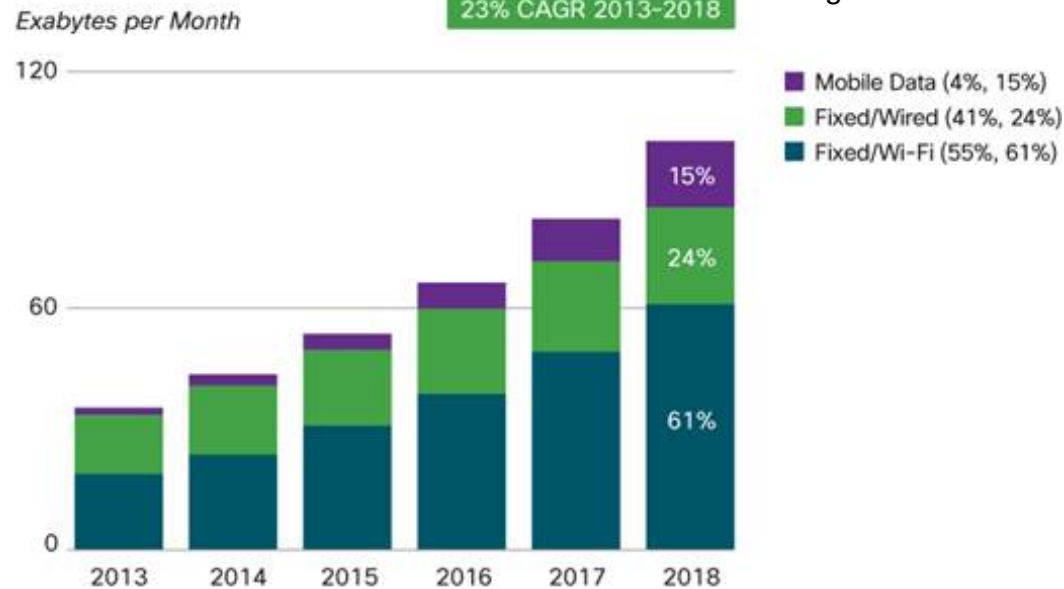
Figure 10. Global IP Traffic, Wired and Wireless



Source: Cisco VNI, 2014

Narrowing the focus to Internet traffic and excluding managed IP traffic yields a more pronounced trend. By 2018, wired devices will account for 24 percent of Internet traffic, while Wi-Fi and mobile devices will account for 76 percent of Internet traffic (Figure 11). In 2013, wired devices accounted for a little less than half of Internet traffic at 41 percent.

Figure 11. Global Internet Traffic, Wired and Wireless



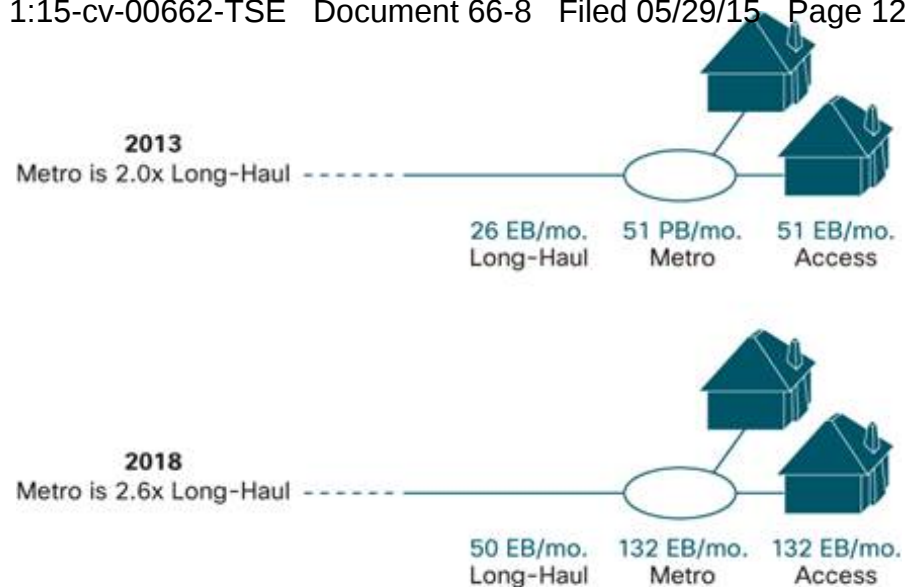
Source: Cisco VNI, 2014

The percentages in parentheses next to the legend refer to traffic share in 2013 and 2018, respectively.

Trend 5: Metro Traffic Will Grow Faster than Long-Haul Traffic

Metro-only traffic (traffic that traverses only the metro and bypasses long-haul traffic links) surpasses long-haul traffic in 2013, and will account for 62 percent of total IP traffic by 2018. Metro-only traffic will grow nearly twice as fast as long-haul traffic from 2013 to 2018. Long-haul traffic is also deposited onto metro networks so that total metro traffic already exceeds long-haul traffic. In 2013, total metro traffic was 2.0 times higher than long-haul traffic, and by 2018, metro traffic will be 2.6 times higher than long-haul (Figure 12).

Figure 12. Metro Compared with Long-Haul Traffic Topology, 2013 and 2018



Source: Cisco VNI, 2014

The faster growth of metro traffic compared with long-haul is due in part to content delivery networks, which will carry 55 percent of total Internet traffic by 2018 (Figure 13). While network performance is usually attributed to the speeds and latencies offered by the service provider, the delivery algorithms used by content delivery networks have an equal if not more significant bearing on video quality.

Figure 13. Content Delivery Network Internet Traffic, 2013 and 2018



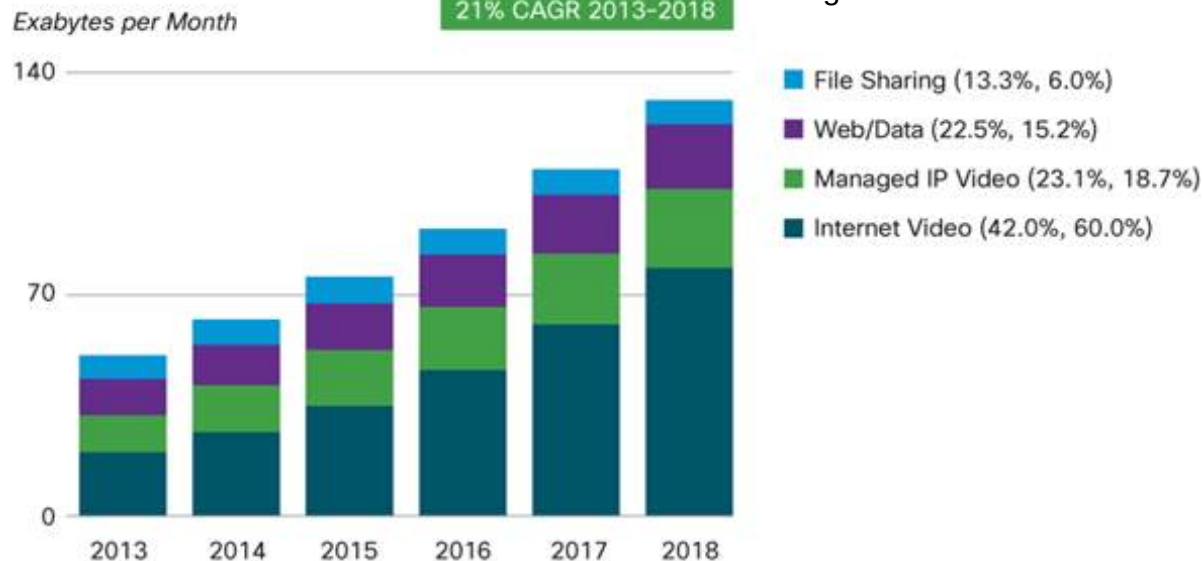
Source: Cisco VNI, 2014

The percentages within parenthesis next to the legend denote the relative traffic shares in 2013 and 2018.

Trend 6: IP Video Will Accelerate IP Traffic Growth Through 2018

The sum of all forms of IP video, which includes Internet video, IP VoD, video files exchanged through file sharing, video-streamed gaming, and videoconferencing, will continue to be in the range of 80 to 90 percent of total IP traffic. Globally, IP video traffic will account for 79 percent of traffic by 2018 (Figure 14).

Figure 14. Global IP Traffic by Application Category



The implications of video growth would be difficult to overstate. With video growth, Internet traffic is evolving from a relatively steady stream of traffic (characteristic of P2P^[1]) to a more dynamic traffic pattern.

Impact of Video on Traffic Symmetry

With the exception of short-form video and video calling, most forms of Internet video do not have a large upstream component.

As a result, traffic is not becoming more symmetric as many expected when user-generated content first became popular. The emergence of subscribers as content producers is an extremely important social, economic, and cultural phenomenon, but subscribers still consume far more video than they produce. Upstream traffic has been flat as a percentage for several years, according to data from the participants in the Cisco VNI Usage program.

It appears likely that residential Internet traffic will remain asymmetric for the next few years. However, numerous scenarios could result in a move toward increased symmetry; for example:

- Content providers and distributors could adopt P2P as a distribution mechanism. There has been a strong case for P2P as a low-cost content delivery system for many years, yet most content providers and distributors have opted for direct distribution, with the exception of applications such as PPStream and PPLive in China, which offer live video streaming through P2P, and have had great success. If content providers in other regions follow suit, traffic could rapidly become highly symmetric.

- High-end video communications could accelerate, requiring symmetric bandwidth. PC-to-PC videocalling is gaining momentum, and the nascent mobile video calling market appears to have promise. If high-end video calling becomes popular, traffic could move toward greater symmetry.

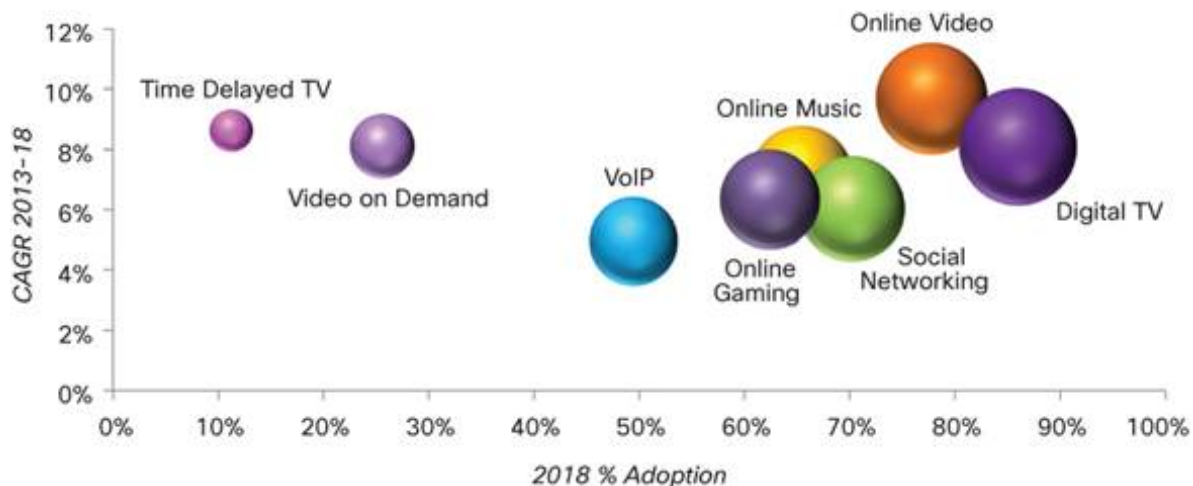
Generally, if service providers provide ample upstream bandwidth, applications that use upstream capacity will begin to appear.

Trend 7: Residential, Business, and Consumer Mobile Service Adoption

Residential Services: Video Continues to Grow

Between 2012 and 2013, the highest growth happened on the Internet side in online video with 16 percent year-over-year growth. On the TV side, VoD grew 17 percent and digital TV and personal video recorder (PVR) services grew at 15 percent. See Figure 15.

Figure 15. Residential Services Adoption and Growth



Source: Cisco VNI Service Adoption Forecast, 2013-2018

Note: By 2018, the global residential fixed internet population will be 2.5 billion; the number of global TV households will be 1.8 billion.

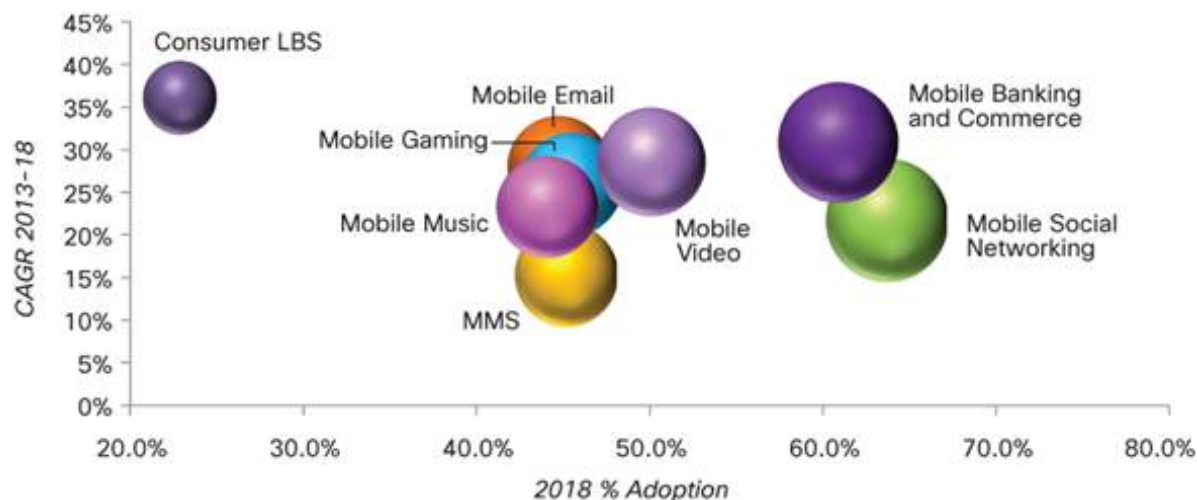
By 2018, digital TV and online video will be the two most highly penetrated services, 86 percent and 78 percent respectively. The fastest growth will come from online video (10 percent CAGR). Online music and video are both driven by cloud-based personal storage and sharing sites, in addition to both copyrighted and user-generated content use.

Among the digital TV services, time-delayed or digital video recorder (DVR)/PVR service will grow the fastest at 9 percent CAGR.

Consumer Mobile Services

Between 2012 and 2013, all the services in this segment grew more than 20 percent year over year. The highest growth was in consumer location-based services (LBS) with year-over-year growth of 81 percent, although from a very small base of 130 million users in 2012 to 236 million in 2013. Other significant year-over-year growth was in mobile banking and commerce (61 percent) followed by mobile video (59 percent). Middle East and Africa had the largest growth at 112 percent, more than doubling the online video users from 14 million to 30 million. See Figure 16.

Figure 16. Consumer Mobile Services Adoption and Growth



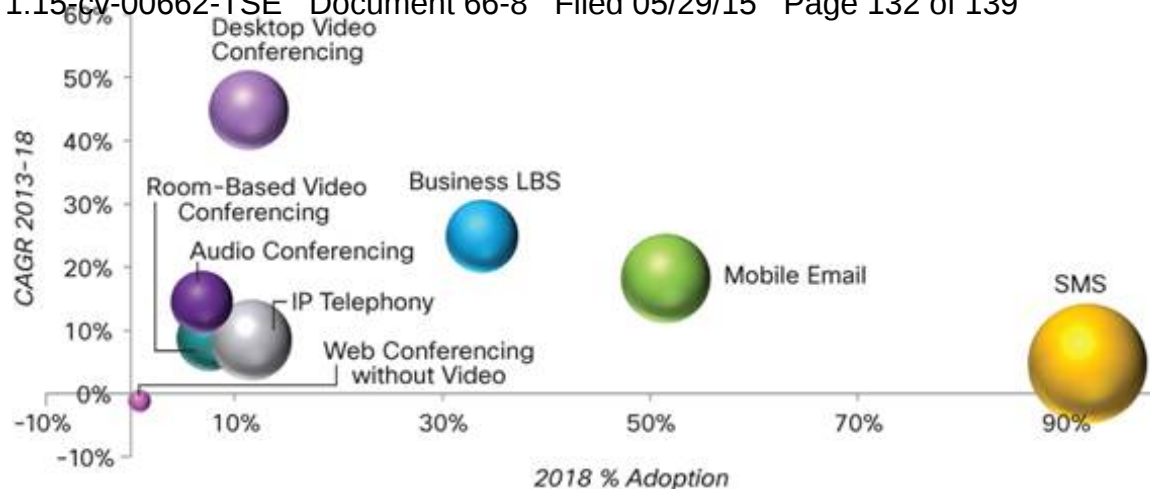
Source: Cisco VNI Service Adoption Forecast, 2013-2018
 Note: By 2018, the global consumer mobile population will be 4.8 billion.

From 2013 to 2018, seven out of eight consumer mobile services will grow at more than 20 percent CAGR, and two will grow at more than 30 percent CAGR. The fastest growth will be in consumer LBS (36 percent) followed by mobile commerce (31 percent). Regions that are really driving mobile commerce growth are Latin America, Asia Pacific, and Middle East and Africa, which have been historically underserved (or not reached) by traditional brick-and-mortar financial institutions.

Business Services

Between 2012 and 2013, the highest year-over-year growth was in business LBS with a 47 percent increase, from 44 million users in 2012 to 65 million in 2013. Other significant year-over-year growth was in desktop videoconferencing (44 percent). See Figure 17.

Figure 17. Business Services Adoption and Growth



Source: Cisco VNI Service Adoption Forecast, 2013-2018

Note: By 2018, the global business Internet population will be 2.1 billion; the number of business mobile users will be 582 million.

Business LBS includes services used by corporate subscribers in which the subscription is generally paid by the employer. As such, it includes but is not limited to services such as salesforce and field-force automation, fleet management, etc.

This year's study suggests lower growth in room-based videoconferencing users. Single-codec videoconferencing systems grew, but with the exception of Latin America, all regions experienced a decline in executive conferencing systems and multicodec systems. Multicodec systems are typically fully managed and as such are expensive to keep and operate. As unit sales drop, so does the network of units to connect to, and therefore, usage may be limited. Low-use systems are decommissioned over time due to the high fixed cost of managing these systems.

From 2013 to 2018, the fastest-growing business service is expected to be desktop or personal videoconferencing. The growth of personal videoconferencing, specifically unified communications-based videoconferencing, has recently accelerated due to the higher quality and lower price of new services and products, and also due to the availability of desktop videoconferencing offers, which can stand alone or be integrated. Also, the growth of mobile clients is going to support videoconferencing growth. Conversely, the use of web conferencing without video will show a decline of 1 percent CAGR over the forecast period.

For details on all aspects of the service adoption study, use the [Cisco VNI SA highlights tool](#).

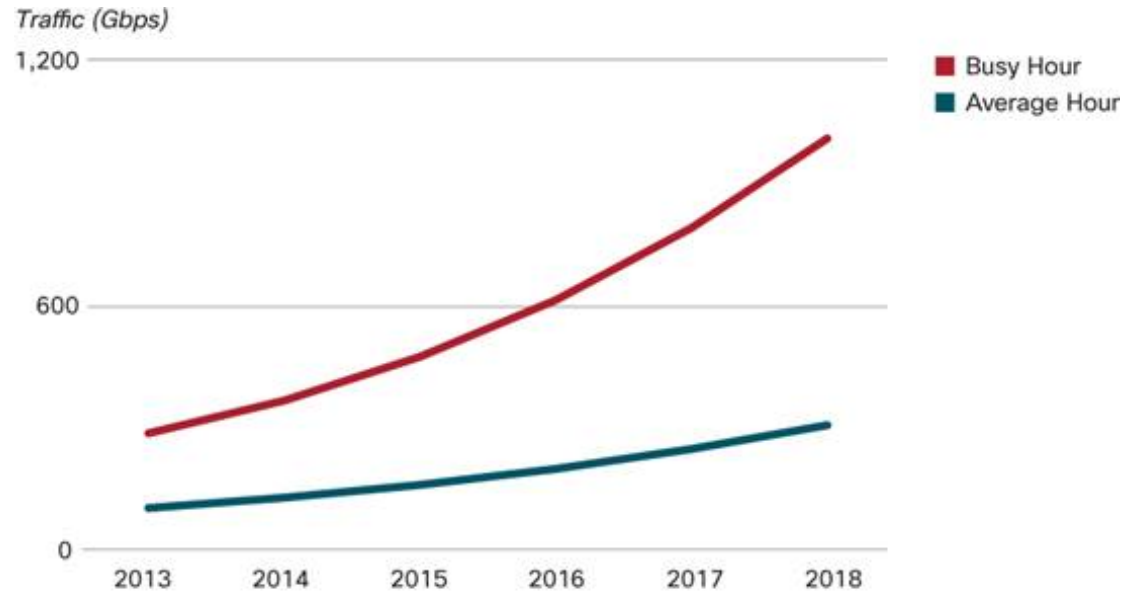
Trend 8: Busy-Hour Traffic Will Grow Faster than Average Traffic

While average Internet traffic has settled into a steady growth pattern, busy-hour (or the busiest 60-minute period of the day) traffic continues to grow more rapidly than average traffic. Service providers plan network capacity according

to peak growth, rather than average. In 2013, busy-hour Internet traffic grew 32 percent, while average traffic grew at 25 percent. The difference between busy-hour and average Internet growth was particularly pronounced in Saudi Arabia, where busy-hour growth was 65 percent in 2013 (compared with average-hour growth of 58 percent), and in India, where busy-hour growth was 66 percent in 2013 (compared with average-hour growth of 54 percent). Between 2013 and 2018, global busy-hour Internet use will grow at a CAGR of 28 percent, compared with 23 percent for average Internet traffic (Figure 18).

Video is the underlying reason for accelerated busy-hour traffic growth. Unlike other forms of traffic that are spread evenly throughout the day (such as web browsing and file sharing), video tends to have a “prime time.” Because of video consumption patterns, the Internet now has a much busier busy hour. Because video has a higher peak-to-average ratio than data or file sharing, and because video is gaining traffic share, peak Internet traffic will grow faster than average traffic. The growing gap between peak and average traffic is amplified further by the changing composition of Internet video. Real-time video such as live video, ambient video, and video calling has a peak-to-average ratio that is higher than on-demand video.

Figure 18. Busy-Hour Compared with Average Internet Traffic Growth



Source: Cisco VNI, 2014

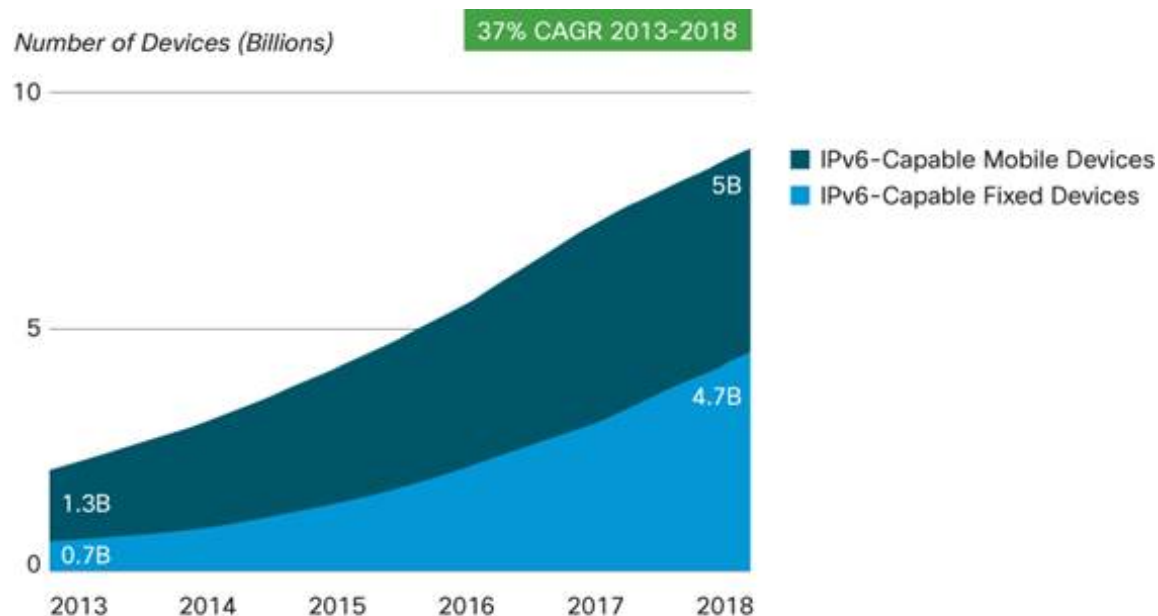
Trend 9: IPv6 Devices and Connections

The transition from an IPV4 environment to an IPV6 environment is making great progress in IPv6 device capability, content enablement, and operators implementing IPv6 in their networks. These developments are particularly important because Asia and Europe have already exhausted their IPv4 allotment, and North America, Africa, and Latin America expect to allocate their

Building upon the VNI IPv6-capable devices analysis initiated in 2012, the forecast estimates that globally, there will be 10 billion IPv6-capable fixed and mobile devices by 2018, up from 2 billion in 2013, a CAGR of 37 percent. In terms of percentages, 47 percent of all fixed and mobile networked devices will be IPv6-capable in 2018, up from 16 percent in 2013. See Figure 19. What that means is that by 2018, about 50 percent of all fixed and mobile devices and connections will be IPv6 capable.

This estimate is based on the capability of the device and the network connection to support IPv6, and is not a projection of active IPv6 connections. Mobile-device IPv6 capability is assessed based on OS support of IPv6 as well as by estimating the type of mobile network infrastructure the device is capable of connecting to (3.5G or higher.) Fixed-device IPv6 capability is assessed on device support of IPv6 as well as an estimation of residential CPE or business router capability to support IPv6, depending on the device end-user segment.

Figure 19. IPv6-Capable Devices and Connections Forecast 2013–2018



Source: Cisco VNI Global IPv6 Forecast, 2013-2018

Leading IPv6-capable device segments include:

- Globally, 80 percent of smartphones and tablets will be IPv6-capable by 2018, up from 43 percent in 2013.
- Globally, there will be 3.9 billion IPv6-capable smartphones and tablets by 2018, up from 882 million in 2013.
- 94 percent of laptops will be IPv6-capable by 2018, reaching 797 million.

- 54 percent of M2M connections will be IPv6-capable by 2018, reaching 2.4 billion.

According to the [World IPv6 Launch Organization](#) in April 2014, fixed and mobile network operators worldwide are deploying IPv6 and starting to report notable IPv6 traffic generation, ranging up to 49 percent of network traffic with Verizon Wireless at 48.71 percent, France's Free Telecom at 37.52 percent, Romania's RCS and RDS at 24.86 percent, AT&T at 17.88 percent and KDDI at 11.41 percent.

Trend 10: Tiered Pricing: Comparing Mobile and Fixed Data Caps

Speeds influence application use and user behavior and user behaviors are what operators want to manage, optimize and monetize; which looks into the behavior of the top usage subscribers and the institution of usage based tiered pricing.

On the mobile networks, based on the usage of over 33,000 lines from a few Tier 1 mobile operators from 2010 to 2013, we found that the Top 1% usage of monthly traffic is down to 10% of overall usage compared to 52% in 2010; showing the effects of tiered pricing. With mobile penetration reaching a saturation point in many countries across all regions, the trend has been moving towards tiered plans as a way to monetize data and effectively manage/throttle the top users of traffic. On the fixed networks, data caps continue to increase to match subscribers growing appetite for video. In the US, Tier 1 carriers are considering 500 GB as a possible monthly limit by the 2018 timeframe from a variety of offerings today. A large provider in Japan has a 30 GB per day upload cap per day. In several countries around the world, Netflix has a sizeable of the internet video minutes and traffic. Wild card traffic generators such as Twitch.TV, a live streaming service where video gamers watch each other play has established itself on many fixed networks across the globe.

Data caps impact a larger percentage of mobile users than fixed. With Tier 1 carriers, approximately 4 percent of mobile users consume more than 2 GB per month (a common mobile data cap); while only 2 percent of fixed users consume more than 250 GB per month (a common fixed data cap).

Other Trends to Watch

Cisco's approach to forecasting IP traffic is conservative, and certain emerging trends have the potential to increase the traffic outlook significantly. The most rapid upswings in traffic occur when consumer media consumption migrates from offline to online or from broadcast to unicast:

- **Applications that might migrate from offline to online (cloud):** The crucial application to watch in this category is gaming. Gaming on demand and streaming gaming platforms have been in development for several years, with many newly released in 2013 or 2014. With traditional gaming, graphical processing is done locally on the gamer's computer or console. With cloud gaming, game graphics are produced on a remote server and transmitted over the network to the gamer. Currently, online gaming traffic represents only 0.04 percent of the total information

content associated with online and offline game play^[2]. If cloud gaming takes hold, gaming could quickly become one of the largest Internet traffic categories.

- **Behavior that might migrate from broadcast to unicast:** Live TV is currently distributed by means of a broadcast network, which is highly efficient in that it carries one stream to many viewers. Live TV over the Internet would carry a separate stream for each viewer. AT&T in the past estimated that a shift from multicast or broadcast to over-the-top unicast “would multiply the IP backbone traffic by more than an order of magnitude”^[3].
- **New consumer behavior:** The adoption of UHD TV would fall into the category of new consumer behavior. UHD is already growing tangible in terms of supporting devices and content. Video providers are preparing to broadcast and stream UHD. Higher resolution and network requirements to stream UHD will create traffic multiplier effects. This nascent traffic type can cause surprises that have network design implications.

For More Information

For more information about Cisco’s IP traffic forecast, refer to “Cisco VNI: Forecast and Methodology, 2013–2018” and visit the other resources and updates at www.cisco.com/go/vni. Several interactive tools allow you to create custom highlights and forecast charts by region, by country, by application, and by end-user segment. Refer to the [Cisco VNI Highlights tool](#) and the [Cisco VNI Forecast Widget tool](#). Inquiries can be directed to traffic-inquiries@cisco.com.

Appendix A: Cisco Global IP Traffic Forecast

Table 7 shows the summary of Cisco's global IP traffic forecast. For more information and additional tables, refer to "CiscoVNI: Forecast and Methodology, 2013–2018."

Table 7. Table A-1 Global IP Traffic, 2013–2018

IP Traffic, 2011–2016							
	2013	2014	2015	2016	2017	2018	CAGR 2013– 2018
By Type (Petabytes [PB] per Month)							
Fixed Internet	34,952	42,119	50,504	60,540	72,557	86,409	20%
Managed IP	14,736	17,774	20,898	23,738	26,361	29,305	15%
Mobile data	1,480	2,582	4,337	6,981	10,788	15,838	61%
By Segment (PB per Month)							
Consumer	40,905	50,375	61,439	74,361	89,689	107,958	21%
Business	10,263	12,100	14,300	16,899	20,016	23,595	18%
By Geography (PB per Month)							
Asia Pacific	17,950	22,119	26,869	32,383	39,086	47,273	21%
North America	16,607	20,293	24,599	29,377	34,552	40,545	20%
Western Europe	8,396	9,739	11,336	13,443	16,051	19,257	18%
Central and	3,654	4,416	5,443	6,666	8,332	10,223	23%

Eastern Europe							
Latin America	3,488	4,361	5,318	6,363	7,576	8,931	21%
Middle East and Africa	1,074	1,546	2,174	3,027	4,108	5,324	38%
Total (PB per Month)							
Total IP traffic	51,168	62,476	75,739	91,260	109,705	131,553	21%

Source: Cisco VNI, 2014

Definitions

- **Consumer:** Includes fixed IP traffic generated by households, university populations, and Internet cafés
- **Business:** Includes fixed IP WAN or Internet traffic, excluding backup traffic, generated by businesses and governments
- **Mobile:** Includes Internet traffic that travels over 2G, 3G, or 4G mobile access technology
- **Internet:** Denotes all IP traffic that crosses an Internet backbone
- **Non-Internet IP:** Includes corporate IP WAN traffic, IP transport of TV and VoD, and mobile “walled-garden” traffic

[1] Peer-to-peer (P2P), by definition, is highly symmetric traffic, with between 40 and 60 percent of P2P traffic consisting of upstream traffic. For every high-definition movie downloaded, approximately the same amount of traffic is uploaded to a peer. Now, with increased video traffic, most video streams that cross the network have a highly asymmetric profile, consisting mostly of downstream traffic, except in areas where P2P TV is prevalent (in China, for example).

[2] Total game play (online and offline) in the United States represents an estimated 166 exabytes per month, according to the University of California, San Diego, study, “[How Much Information?](#)”

[3] Alexandre Gerber and Robert Doverspike, “[Traffic Types and Growth in Backbone Networks.](#)”

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