Internet Society

2019

Consolidation in the Internet Economy

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Foreword

Foreword by
Andrew Sullivan,
President and CEO,
Internet Society

The Internet Society develops its Global Internet Reports to bring significant features of the Internet's evolution to the attention of the global Internet community. The report normally contains some recommendations about the topic, proposing action to be taken or avoided as the topic and conditions warrant. This year, we examine the topics of concentration and consolidation on the Internet.

There can be little question that the Internet is facing change due to concentration and consolidation. The two patterns are linked but nevertheless distinct. We can observe the patterns at several levels:

- Transit on the Internet is consolidating. Long-haul transit operators are becoming fewer but larger because of mergers and acquisitions. Even in access provisioning, some jurisdictions are seeing fewer, larger ISPs and consolidated offerings across the market.

- Delivery of standard Internet services is consolidating in large providers. For several years now, for example, most Simple Mail Transport Protocol (SMTP) traffic has come from just a few mail service providers, who provide that service for a very large percentage of Internet users, including businesses. Similarly, the Domain Name System (DNS) services were historically operated in a highly distributed way. Today, a small number

of large providers serve the domains of most commercially-significant domains on the Internet, and actual resolution of names (turning the names we click on into numbers that connect between computers) is often provided by a small number of resolvers. The DNS protocols are even changing in a way that reinforces this trend.

- Infrastructure, both to operate services and run applications, is increasingly provided in cloud and edge computing environments. These services deliver to even the smallest customers capabilities that were once available only to the largest operators, if they were available at all.

- Web applications and platforms, which are built atop the public Web but usually depend on proprietary APIs, appear to function as near monopolies. They are subject to rock star economics, where only the largest and most famous profit.

All of these patterns are observable on the Internet today. Each has the potential to alter how the Internet works, and together they may represent a challenge to the traditional Internet architecture. They may change what sorts of development we should expect.

It is important to state that this evolution isn't necessarily good or bad. It is merely an observable fact about the Internet's evolution. This year, the

Internet Society intended to lay out what that evolution is, what it might mean for Internet users, and what the appropriate technical and policy responses might be.

We discovered that we had set ourselves an unreasonable task. Our analysis did not lead to a clear set of recommendations, but instead to an even longer set of questions that we think we need answers to before we have anything sensible to recommend.

Of course, knowing what one does not know is already an advance from pure ignorance. And, we can say that we have uncovered indicators in both directions. For example, we can see that some options for people on the Internet have clearly become better, cheaper, or both due to the existence of very large economies of scale. Some platforms have become massively successful, and we might reasonably infer that this is partly because they provide something their users want.

In addition, large providers can bring to bear technical expertise that most ordinary enterprises cannot: only large operators have the capacity to employ specialised protocol and security experts, for instance. At the same time, consolidation of Internet service onto a few proprietary systems controlled by few (perhaps even fewer) companies with enormous financial resources may present a challenge both to the Internet and wider society. Moreover, highly integrated systems that depend on a single vendor may be more brittle, or subject to failures that have widespread effects.

Accordingly, this Global Internet Report provides the questions for subsequent efforts to answer. Such efforts will allow further understanding that can provide the path forward for the global Internet community. In the coming year, the Internet Society will do the necessary research, with the goal of providing a more positive program in the next report. At the same time, this uncertainty warns us all against too-hasty regulatory or legislative action. It is possible that some developments that look alarming might turn out, on balance, to be good for people, and it would be unfortunate if those good developments were damaged by hasty regulations or laws.

This Global Internet Report tells us that the Internet Society has a great deal of work to do. We must understand what concentration and consolidation on the Internet mean, both for its architecture and for the wider society that depends on the Internet. We must understand what is really happening to the Internet in order to ensure that we build the Internet for everyone.

2

Executive Summary

Executive Summary

The Internet is changing.

From the underlying infrastructure to the way users engage, the Internet is evolving in many ways. The Internet Society's 2017 report foresaw a hyperconnected Internet economy, one in which no sector of the economy or part of society would be untouched by technology. Among the other questions it posed, the report also asked if this technology-driven disruption would favour the existing Internet economy players, or usher in greater competition and entrepreneurship. In the 2019 report, the Internet Society explores the evolving Internet economy further. It examines the growing presence the Internet platforms have in the Internet economy, and what the implications might be for society, innovation, competition, and the economy, as well as the Internet's broader architecture.

In the 2019 report, the Internet Society asks whether the Internet economy is consolidating and, if it is, what the implications might be. From the dominance of Facebook in social messaging, Google in search and Amazon in online shopping, the largest Internet platforms are capturing fundamental human interactions. This dominance, and the finances and reach that accompany it, enable the platforms to extend their influence and reach into new market spaces, from autonomous vehicles, to AI, to cloud services and beyond. This leverage is built on unprecedented network effects, vast troves of user data, business agility, and regulatory freedom that few other companies enjoy.

In this report, the Internet Society recognises the incredible convenience these platforms provide the Internet user. At the same time, the Internet Society also recognises the concerns that are being voiced about this dominance, and about the responsibility these companies have to society and economy. The 2019 report explores these issues by examining five key trends and themes that emerged from extensive engagement with the Internet Society community, and surveys and interviews with experts, thought leaders and influencers.

The first trend is what we call the evolution of "total service environments." The Internet platforms have evolved in providing a range of communications, entertainment, and

productivity and lifestyle services and tools designed to be incredibly convenient. In essence, these environments provide default one-stop shop access to the Internet. To keep users engaged and continue to grow revenues, the Internet platforms expand into new service and content areas.

At the same time, the full service environments operate at a scale that allows entrepreneurs to do things they could not otherwise, like access a far larger customer base, resources, and expertise that no small business could tap using its own limited resources or time. While platform environments unleash huge opportunities, they could also limit innovation by promoting the interests of the platforms over those of users, thereby limiting competition and user choice.

We also observe that interoperability, and standard development and deployment are increasingly becoming a function of scale. In this case, open, collaborative, and interoperable Internet is influenced by a small number of large companies, and organisational scale and market share play a significant role in the development and deployment of the open technical standards on which the Internet depends. A small number of large companies influence the nature of an open, collaborative and interoperable Internet. These large organisations can also accelerate the adoption of existing but under-deployed standards like IPv6, and push the development and testing of new standards, benefitting the Internet as a whole.

But the growing use of largely platform-driven APIs puts more of the Internet's functionality and interoperability in the hands of immensely powerful ecosystems, whose interests may not align with those of others. Finally, future innovation, services and applications may depend on the availability of a small set of proprietary platforms and services, rendering those applications less resilient, reliable, and capable of supporting further innovation.

Inevitably, the topology of the Internet is also changing. The ability of a small number of content and cloud services to invest in their own networks and deploy their servers close to the broadband network edge is amplifying the existing trend of a "flattening"

Internet, where access networks are increasingly interconnected and have less need for international transit. Access networks are evolving rapidly, driven by Internet of Things (IoT) deployments and other demands for processing on a range of user devices, including evolving technologies such as autonomous vehicles. Big cloud providers – some of which are also large Internet platform entities – are well-placed to dominate the new era of IoT and edge computing. This further drives a changed Internet topology with less international transit and more complex, private, specialised networks, and services.

One of the consequences of the consolidation and concentration we have outlined so far is what we call "deep dependencies." Default one-stop shops, interoperability, and standards development and implementation at scale, as well as the flattening of the Internet's infrastructure, are all the result of the concentration and consolidation in key areas. This creates dependencies both within layers and cross layers of the Internet. The development of new applications, services and businesses across the global economy is increasingly dependent on a small number of private platforms owned by the largest Internet companies.

While the risk of catastrophic failure may be minimal, it could create a domino effect for other parts of the global economy. As platform environments expand further, entering and often dominating more sectors and markets there is a risk of growing societal dependencies on a handful of powerful economic actors. The risk is magnified by an exceptional economic power. That a company or technology is vulnerable to disruption, evolution, and competition has been one of the Internet's defining successes — what the Internet Society calls the characteristic of "no permanent favourites." This characteristic could be challenged as dependencies continue to grow.

The fifth trend is the growing number of responses to the negative effects — either real or perceived — of concentration and consolidation. There is a growing interest and a greater will among governments to address the challenging issues affecting economy, society and governance. These issues, ranging from

fake news to anti-competitive practices, are found across the applications, services, and access domains of the Internet economy. They are found in different sectors, regions, and by different institutions. Countries have adopted different strategies in response. Some have a higher tolerance for the risk of dominance if it also delivers Internet access and services, while others have a traditionally lower tendency to regulate. At the same time, other countries, such as those in the European Union, are mobilizing concerted, cross-agency responses, which often span across competition, consumer protection, and data protection regulators. Similarly, different stakeholder groups have also focused on different issues as far as dominance is concerned.
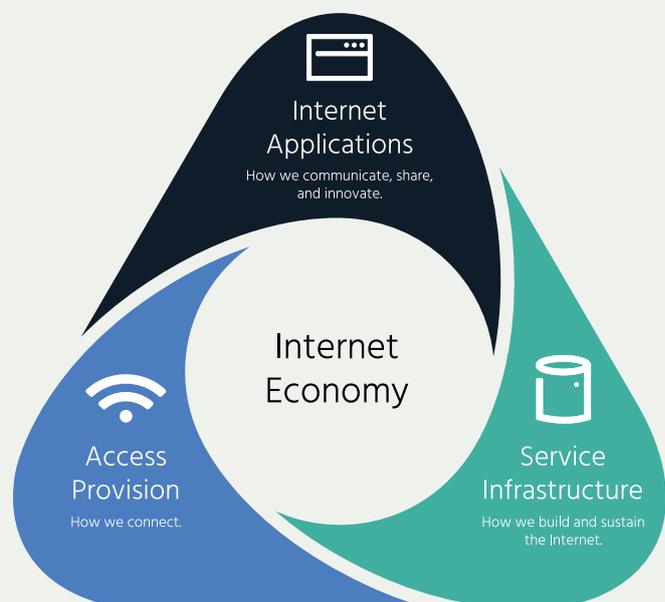
The Internet Society recognises that the impact of consolidation and concentration on the Internet economy as well as on the open, interoperable, and global Internet are difficult to gauge. As noted already, there are benefits to operating at scale. Consolidation and concentration can also greatly benefit the user by providing platforms that offer seamless Internet experiences. At the same time, it's unclear what the impact is on innovation, entrepreneurship and, importantly, competition. It's unclear what

concentration and consolidation may mean for user choice, including choice of content, services, and provider.

The final section of the report outlines a series of questions the Internet Society, the broader community, and all stakeholders with an interest in a thriving Internet should consider. The Internet Society will incorporate these questions into its plan of action for 2019 with the goal of addressing some of them in next year's report. We look forward to the community's continued engagement and support as we have an ongoing discussion in the year ahead.

Internet Economy

The Internet economy, as understood in this report, is broadly defined as the economic activities that either support the Internet or are fundamentally dependent on the Internet's existence.

Internet Applications
How we communicate, share, and innovate.

Internet Economy

Access Provision
How we connect.

Service Infrastructure
How we build and sustain the Internet.

3

Introduction

Introduction

In 2017, the Internet Society published a comprehensive study to better understand the forces of change that will shape the Internet over the next five to seven years: The 2017 Global Internet Report: Paths to Our Digital Future. These forces, or "Drivers of Change," were identified through extensive consultations with experts in and out of the Internet Society's global community. The drivers encompass technological, economic, regulatory, security, and network-related opportunities and challenges for the Internet of the future. Among the driving forces our community identified was the Internet economy.

Specifically, the community identified a concern that a lack of competition and increased market concentration could have severe implications for the Internet's technical evolution and use. Our goal for this new report was therefore to explore trends of consolidation in the Internet economy, guided by the central question: *Are there trends of consolidation in the Internet economy, and if so, how will consolidation impact the Internet's technical evolution and use?*

Consolidation is not a new phenomenon, but often a natural evolution as industries and markets mature. Opportunities to reduce costs, expand market share, and enhance scalability are intrinsic incentives in any economic domain where companies acquire competitors or incorporate parts of the production chain. This is also true for the Internet economy, where we've seen some trends of consolidation in various markets. These are understood as growing forces of concentration, vertical and horizontal integration, and shrinking opportunities for market entry and competition.

The fact that a few corporations dominate large parts of the Internet is not news. Today, a handful of actors play a significant role in our increasingly-connected societies. In this context it's important to consider what the implications of those trends are, not only from an economic perspective but also in terms of how they may shape the Internet in coming years.

What became evident throughout this work is that consolidation in the Internet economy raises a much more complex set of issues than what the popular press typically covers. Investigating trends of consolidation is indeed a challenging task because its impact is a complex story of benefits and threats. **As policymakers and other decision makers read this report, we hope they begin to understand this nuance,** which manifests itself at a number of different yet interrelated layers of the Internet economy: Applications and Services; Access Services; and Service Infrastructure.

In this report, **we have outlined what we think the benefits and the threats are,** and what features from the current trends of consolidation we believe are important as we look towards the future. As such, this report is not intended to provide an in-depth economic analysis, but rather a collection of observations that has been gathered through research and with the help of our global community.

While most questions remain unanswered, we believe that many of them are too important to ignore. Instead, this project has prompted even more questions that have made it clear that consolidation is a topic that will require further work. The work must be done not only by us, but hopefully in collaboration with the broader Internet community.

4

How We See the Internet
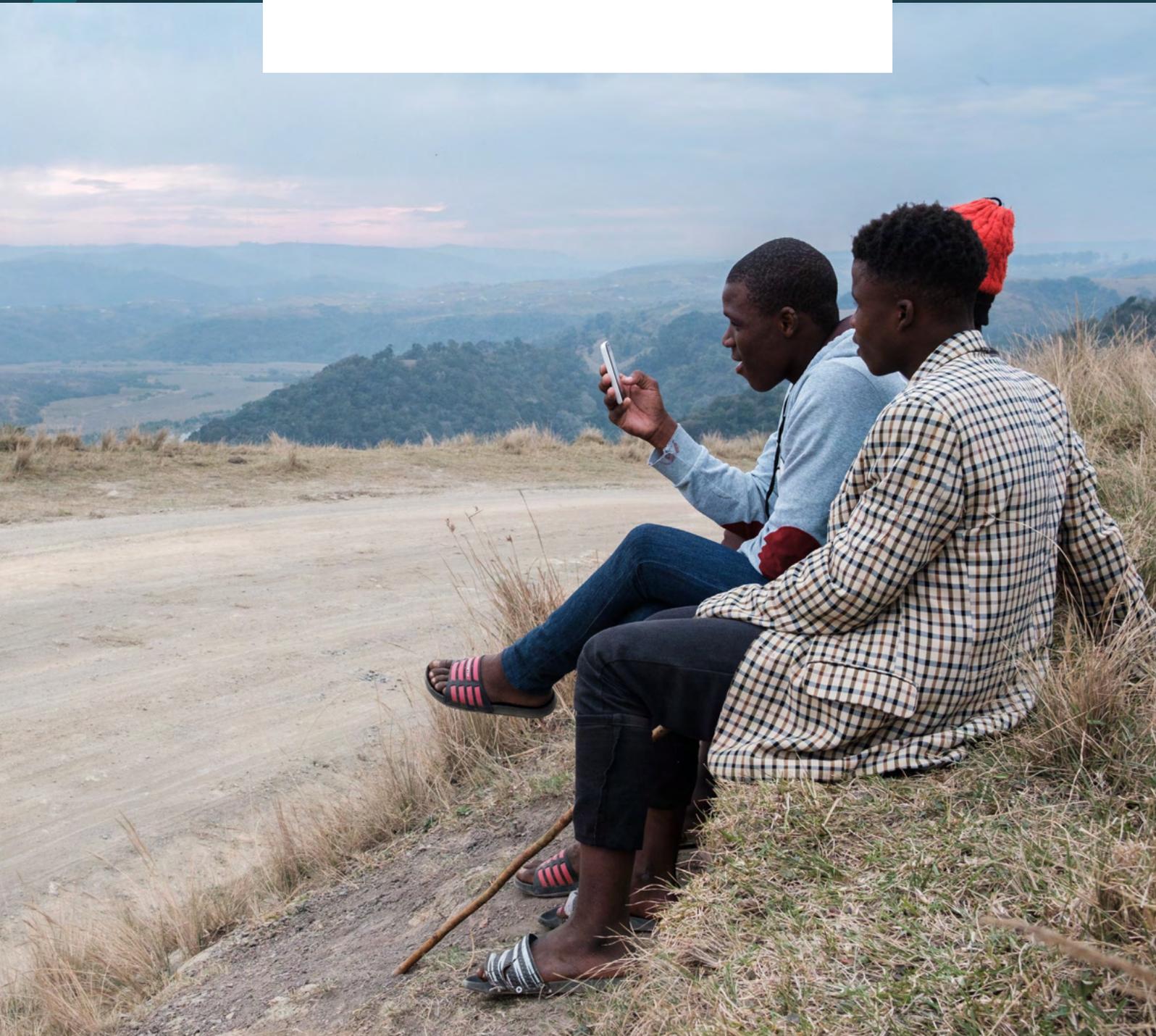
How We See the Internet

Defining how we at the Internet Society see the Internet is an important first step. When we think about the Internet, what comes to mind for many of us is something beyond the technology of the Internet itself. By definition, the Internet is a technical system: a communications infrastructure that enables networks around the globe to interconnect. It's a network of networks. That said, over the past two decades, the Internet has come to mean far more than just the technology. With more than 4 billion people online today, the Internet is now an integral part of the social and economic fabric of many communities around the world.

In the text below, we identify the important properties that make the Internet such a powerful platform and describe what this means for the users of the Internet. **This framework will help to guide us in considering the questions of consolidation in the Internet economy.**

> The Internet Society capitalises the term "Internet" to differentiate the global Internet from generic "internets," which can refer to any interconnected group of computer networks.[1]

Fundamental properties of the Internet

In the history of humankind, few technologies have resulted in such widespread social and economic change in a relatively short period of time. Growing nearly 900% from 400 million in 2000 to more than 4 billion users today,[2] the Internet has had an unprecedented impact on economies and societies around the globe.

Conversely, the impact of the Internet on society has also transformed how we use the Internet. It is no longer just the home of email, static webpages, and discussion boards. Today's Internet is so much more. It's a dynamic space for collaboration, commerce, and expression. Video currently accounts for more than two-thirds of all Internet traffic, and

people accessing the Internet via smartphones now dominate.

In spite of all this dynamism, certain properties of the Internet persist. These properties, which we call "invariants," have been the foundation for the Internet since its earliest days. At the same time, it's because of these invariants that the Internet has become such a dynamic resource. These characteristics are at the heart of the Internet's success – they have enabled the Internet to serve as a platform for seemingly limitless innovation, economic growth and opportunities for people everywhere.

Internet Invariants – what really matters about the Internet[3]

Before detailing what we mean by Internet invariants, it is important to clarify that these fundamental, unchanging properties of the Internet are aspirational or ideal conditions. As the Internet moves away from these ideal conditions, we believe the dynamism and innovation that the Internet supports will necessarily diminish. You can think of the Internet as an idea of

how networks of computers communicate, and the invariants describe the most important features of that idea. This concept of the Internet as an idea is operationalised through some familiar protocols (e.g., Internet Protocol, Border Gateway Protocol) and functions (e.g., the Internet Assigned Numbers Authority).

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1   https://www.internetsociety.org/internet/what-internet/history-inter-net/brief-history-internet
2   https://wearesocial.com/us/blog/2018/01/global-digital-report-2018
3   The Internet Invariants concept was developed by Leslie Daigle, former chair of the Internet Architecture Board (IAB) and the Internet Society's

first Chief Internet Technology Officer (CITO). The Internet Invariants stem from an Internet Society panel discussion that took place in 2011. More details of that discussion are available here: https://www.inter-netsociety.org/internet-society-panel-internet-evolution-ietf-81

A network that does not have these fundamental properties is not the Internet.

The Internet has global reach and integrity, and is not constrained in terms of supported services and applications:

Global reach, integrity

Any endpoint of the Internet can address any other endpoint, and the information received at one endpoint is as intended by the sender, wherever the receiver connects to the Internet. Implicit in this is the requirement for globally-unique addressing and naming services.

General purpose

The Internet is capable of supporting a wide range of demands for its use. While some networks within it may be optimised for certain traffic patterns or expected uses, the technology does not place inherent limitations on the applications or services that make use of it. The Internet supports more than the World Wide Web and email.

The Internet is for everyone – there is no central authority that designates or permits different classes of Internet activities:

Supports innovation without requiring permission

Anyone can create a new service, that abides by the existing standards and best practices, and make it available to the rest of the Internet, without requiring special permission. This "permissionless innovation" is crucial to the Internet's success — it removes the barriers to entry. From the World Wide Web to social networking, from BitTorrent to Bitcoins, many of the applications that billions of Internet users enjoy every day, and the many that will be developed in the future, are a product of this fundamental characteristic.

Accessible

There are no inherent limitations on who can access, build, and study the Internet. Anyone can connect to the Internet, not just to consume content from others, but also to contribute content on existing services, create new services, and attach entirely new networks.

The Internet requires some basic agreements and social behaviour between technologies and between humans:

Based on interoperability and mutual agreement

The Internet is a network of autonomous networks. It works because those networks can communicate with each other, based on voluntary adoption of the open standards for the technologies that support it, and through the mutual agreements made between network operators.

Collaboration

Overall, a spirit of collaboration is required. Beyond the initial basis for interoperability (open standards and mutual agreements), the best solutions to new issues that arise stem from willing collaboration between stakeholders. These are sometimes competitive business interests and sometimes different stakeholders altogether. Addressing new issues in a collaborative fashion ensures a diversity of views and reduces the risk of unilateral actions having unintended negative consequences for the Internet and its users.

Although no specific technology defines the Internet, there are some basic characteristics that describe what works:

Technology, reusable building blocks

The Internet is comprised of numerous technologies that together create the Internet as we know it today; however, each individual technology, or building block, may be used for unintended purposes. For example, the Domain Name System (DNS) was developed to provide a distributed name-to-address mapping service, but is now also used to share keying material for securing online transactions. Operational restrictions on the generalised functionality of technologies as originally designed have a negative impact on their viability as building blocks for future solutions.

And, finally, the more the Internet stays the same, the more it changes:

No permanent favourites
The Internet has no permanent favourites. In the 1990s, Netscape and Mosaic were among the most popular web browsers on the Internet. And before the Web itself there was Gopher. Before Facebook and Twitter, MySpace was the dominant social network. Today, more people access the Internet with a mobile device than from a desktop computer. Continued success depends on continued relevance and utility, not strictly some favoured status. Good ideas are overtaken by better ideas and this is part of the natural evolution of the Internet.

Abilities arising from the Internet

The invariants described above are what we believe to be the fundamental characteristics that make the Internet such a powerful and special medium for communication, sharing and innovation. The Internet Society believes that the Internet based on these invariants empowers users with certain abilities. These abilities stem from the invariants and underpin the social and economic value that the Internet provides to people. As we look to the future, these abilities must remain at the heart of the Internet experience for everyone, everywhere.

The ability to connect
The Internet was designed to ensure anywhere-to-anywhere connectivity. All Internet users, regardless of where they live, should have the ability to connect to any other point on the Internet, without technical or other impediments. This ability to connect people is essential to the Internet's value as a platform for innovation, creativity, and economic opportunity.

The ability to speak
The Internet empowers users with the ability to speak globally and in many new forms. Its value as a medium for self-expression is dependent on the ability of its users to speak freely. Private, secure and, when appropriate, anonymous communications ensure that Internet users can express themselves in a safe and secure manner. All Internet users should have the means to communicate and collaborate without restriction.

The ability to innovate
The Internet provides the open connectivity fabric that underpins huge swathes of innovation in terms of both economic activity and social interaction. Combined with open data, widely-adopted mobile computing platforms, and widely-deployed wireless broadband networks, the Internet is fundamental to the ability of individuals and societies to devise new ways of working, playing, organising, and growing.

The ability to share
The Internet enables sharing, learning, and collaboration. The ability to share and openly discuss code online has given rise to the open development of key applications of the Internet, such as the DNS and the World Wide Web. Fundamental to this ability is the concept of fair use, and the freedom to develop and use open source software.

The ability to choose
The Internet empowers users with the ability to make choices from a global marketplace of ideas, goods and services. Although the Internet does not require such a marketplace, its existence, characterised by choice and transparency, allows users to remain in control of their Internet experience.

The ability to trust
Users must be able to trust the Internet and the communications, services, and applications it carries. As originally deployed, the Internet did not provide any intrinsic mechanisms to build or support trust in the network. Consequently, we have seen and will continue to see a huge amount of development effort directed toward retrofitting trust to the Internet at all layers.

The Internet in society

The Internet Invariants provide a guide to what really matters about the Internet in terms of its architecture and technological properties. The abilities highlight the different ways in which the Internet affects human societies and supports us in understanding why people care so much about this technological artefact that is much more than the sum of its parts. Both notions will help guide us as we consider the issues of consolidation in the Internet economy.

5

What Is Consolidation?
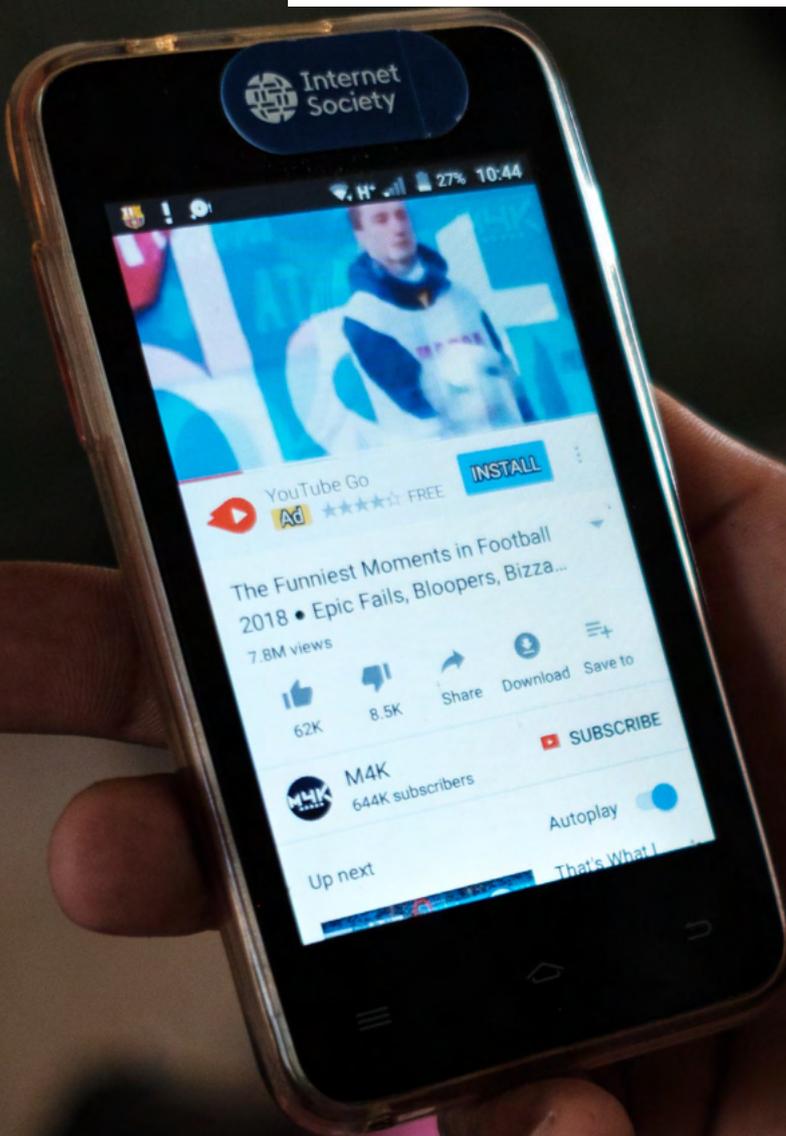
Consolidation in the Internet Economy

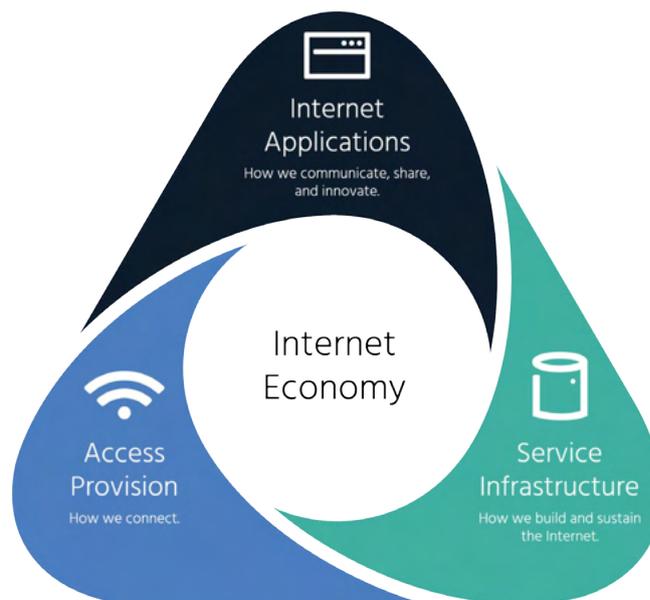The **Internet economy**, as understood in this report, is broadly defined as the economic activities that either support the Internet or are fundamentally dependent on the Internet's existence. Thissection presents an overview of current trends of consolidation in its affiliated markets, including growing forces of concentration, vertical and horizontal integration, and fewer opportunities for market entry and competition. The purpose is to give an overview of different markets, and to provide the analytical basis for the following sections that look closer at how these trends may influence the Internet's evolution.

Organised around three separate but closely linked economic domains (Internet Applications; Access Provision; and Service Infrastructure) this section is intended to provide a snapshot of various markets, and to describe how they relate to the Internet as a whole. As such, it is not intended to provide an in-depth economic analysis, nor is it exhaustive in terms of encompassing all relevant markets and services. Rather, it provides a starting point for further discussion.

Internet Economy

The Internet economy, as understood in this report, is broadly defined as the economic activities that either support the Internet or are fundamentally dependent on the Internet's existence.

> "
> The technology sector is different than other sectors as there are numerous relevant markets having multiple sides, each with specific competition dynamics. This makes the delineation of relevant market difficult. Further, markets are such that given market at one point in time mutates into another through the exploitation of complementarities.
>
> —Payal Malik, Economics Adviser and Chief Economist, Competition Commission of India, Future Thinking, November 2018

Internet Applications

Applications and services shape the experience of Internet users and enable them to communicate, share, and innovate. From search to storefronts to messaging to travel and more, actors in this layer of the digital economy vie for the eyes, minds, and wallets of the Internet user. Today, a small number of companies operating some of the Internet's most popular services dominate this market. Many of these companies act as multi-sided markets or platforms, meaning they offer a base upon which other applications, processes, or technologies can be developed. Value is created through this base by matching customers with complementary needs, examples of which include developers with users, drivers with passengers, or advertisers with consumers.[1]

> "
>
> …Alphabet not only operates an online advertising platform, but also a search engine, a mail platform, a document store, a cloud service, a public DNS resolver service, a mobile device platform, a browser, and mapping services to name just a few. It appears that in this case, it is one enterprise with engagement in many discrete activities. The issue with consolidation is whether these activities remain discrete activities or whether they are being consolidated into a single service.
>
> —Geoff Huston, RIPE NCC, December 2018

"One-stop shops"

The top 5 companies in the application layer today are Alphabet (parent company of Google), Amazon, Tencent, Facebook, and Alibaba:[2]

- Facebook and Google have been estimated to account for 84% of global digital advertising investment (excluding China).[3]

- In 2018, it is expected that Amazon accounted for 49.1% of all online retail spending in the US[4]. Similarly, Alibaba is estimated to have close to 60% of the e-commerce market in China.[5]

- Google alone holds 90% of the global search market[6], over 60% of web browsers[7], the number 1 (by far) mobile operating system (Android)[8], the top user-generated video platform (YouTube)[9], and has more than 1.5 billion active users of its email service (Gmail)[10].

- Facebook – incorporating Facebook Messenger, WhatsApp, and Instagram – dominates social media and messaging globally[11]; holding 4 of the world's top 6 social media platforms.

- Tencent owns WeChat, China's biggest social media platform, with more than 1 billion monthly active users[12]. Tencent's stable of platforms, including QQ, WeChat, and various Tencent-branded social media and content offerings, demand almost 4 times as much user attention on smartphones as Alibaba and Baidu combined[13].

These global tech companies build digital environments that comprise multiple platforms across a diversity of spaces, and are thus often described as digital conglomerates or digital giants[14]. They are largely present in the application layer of the Internet, although they increasingly offer cloud services and infrastructure, as we will explore further below. They are not just the biggest companies on the Internet; they are some of the most valuable companies in the world.

Digital platforms tend to be two-sided markets, meaning they develop useful online spaces or platforms. On one side, people acquire desired products and services, and on the other side, businesses can find customers. These platforms gain market share in their respective markets due to data control and network effects (where the service's value to the user increases with the number of other users).

Footnote References for Section 5 of the report are listed on pages 31 and 32.

54.5% of our survey respondents saw users in their region having a limited choice of applications and services.

Where data is concerned, companies use the openness and cross-border nature of the Internet, along with valuable data about their customer base, to match customers with products and services, and to continuously improve such offerings. The more customers using a service, the more data they generate for the platform. Platforms use data they collect across a range of devices and services to target advertising, generate extra revenue streams from data analytics, improve their offerings, and evolve strategies for moving into new services and markets. Platforms also increasingly use data to feed artificial intelligence (AI) processes designed to anticipate people's purchasing and other behavioural patterns.

Network effects are also central to the value and power of these platforms. The more people use a marketplace like souq.com or a communications app like WhatsApp, the more valuable and attractive it is to current and prospective users. Some platforms open up a limited set of application programming interfaces (APIs) and software development kits (SDKs) to enable external developers to build on a particular functionality or sell to users via the platform (e.g., Google Maps or Apple's App Store). These two-sided markets link innovators and customers while adding value and a stream of innovation to the platform itself.

Platform companies are also effective at attracting and retaining customers because they use their resources – and the data they continue to gather – to provide and continuously improve a one-stop shop. This means that based on what data shows about potential user preferences and needs, platform companies add features that address and test user desires. And data about projected user needs and preferences also guide their acquisition

(or replication[15]) of novel and potentially competitive services. For example, Facebook acquired WhatsApp and Instagram in order to maintain leadership in the social messaging and photo sharing markets.

> "
>
> Like the oil barons at the turn of the 20th century, the data barons are determined to extract as much as possible of a resource that's central to the economy of their time. The more information they can get to feed the algorithms that power their ad-targeting machines and product-recommendation engines, the better.
>
> —MIT Technology Review, 2018

At the core of the platform-user relationship is often the platform's drive to keep extending user time on the platform and deepening their engagement. Platforms retain customers through a virtuous cycle: data that is generated through the use of applications and services feeds the data engine, which in turn creates a better and more tailored Internet experience. This keeps the customer engaged and on the platforms, which generates further data, and so on.

Move fast and leverage dominance

The platforms' dominance in their original domains or markets enables them to rapidly extend into others. Amazon and Alibaba run e-commerce platforms, but also offer cloud platforms. Google's search platform provides most of the company's current revenue, via advertising, but its parent organisation, Alphabet, owns an ever-widening array of companies:[16]

Alphabet

Larry Page, SEO
Sergey Brin, President
Eric Schmidt, Chairman

nest.
Tony Fadell
Thermostats and smart-home devices. Acquired by Google in January 2014.

Access & Energy
Craig Barratt
Energy and internet access – including Fiber, which provides low-cost broadband.

verily
Andy Conrad
Healthcare and disease prevention research. Formerly Google Life Sciences.

Calico
Arthur Levinson
Research into longevity, life expansion. Name stands for California Life Company.

SIDE WALK LABS
Dan Doctoroff
Urban innovation. Solving cities' problems.

Google
Sundar Pichai
All of Google's "traditional" products are here.
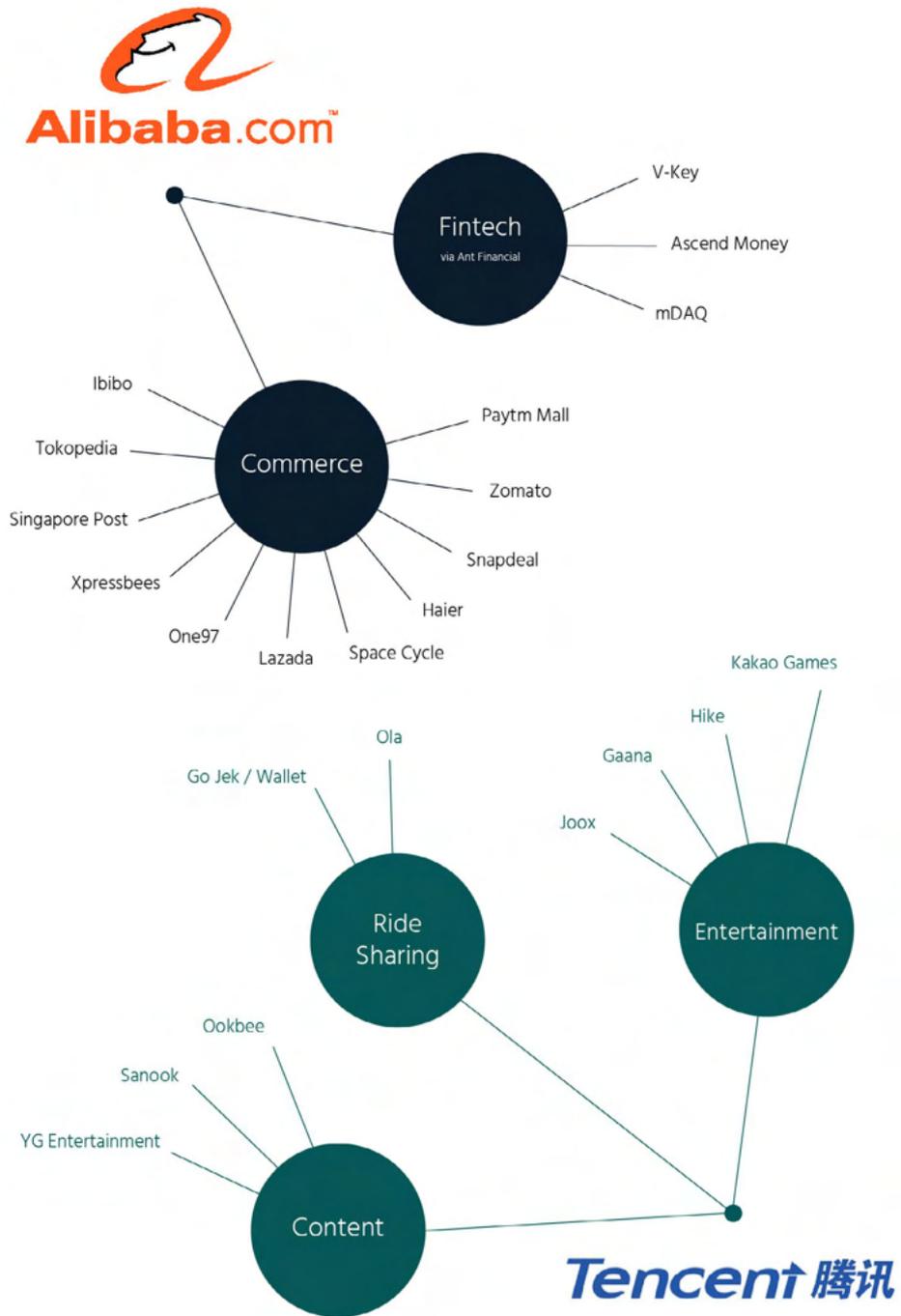
Google [x]
Astro Teller
Secretive "moonshots" and outlandish projects.

GV
Bill Maris
Formerly Google Ventures, GV is Google's venture capital investment arm.

Google capital
David Lawee
A growth equity fund that draws on advisors from Google to help portfolio companies.

Google Self-Driving Car Project
John Krafcik
Self-driving cars. It will reportedly become an Alphabet company in 2016.*

Replicant
Robots. Formerly a separate Alphabet company, it recently rebooted.

PROJECT LOON
Delivering internet to the developing world with high-altitude balloons.

Project Wing
Drone deliveries. Commercial launch in 2017.

Project Titan
High-altitude, solar-powered, internet-delivering drones.

Google Self-Driving Car Project
John Krafcik
Self-driving cars. It will reportedly become an Alphabet company in 2016.

YouTube
Susan Wojcicki
The video-hosting site was acquired by Google in 2006.

G
The original, core Google search engine.

Technical Infrastructure
The backend that powers other units across Alphabet.

Google AdSense
Adverts, which drive the majority of Google's revenue.

[Google Maps]
The famous Google Maps

Google Apps for Work
Applications like Google Docs.

[Android]
Google's dominant mobile operating system.

Google for Work
Google's enterprise division.

Google DeepMind
Artificial intelligence research.

ATAP
Advanced Technology And Projects. A buzzy research lab.

NOTE: The list of Google departments is non-exhaustive, as is the list of Google X projects – because they're so secretive.
SOURCE: Google. As of March 2019.

Business Insider (2016). Google's parent company, Alphabet, explained in one chart. Available at: http://uk.businessinsider.com/chart-of-alphabet-google-parent-company-infographic-x-gv-2016-1

BUSINESS INSIDER

Similarly, Alibaba and Tencent have diversified into new areas:[17]

Like Alphabet, Alibaba and Tencent have expanded well beyond their initial core service. The diagram shows merely a selection of their interests across multiple industry sectors. For example, the Alibaba group owns multiple online market places including Lazada and also Taobao, a consumer-to-consumer platform with more than 600 million active monthly users[18]. Baidu, another large Internet company operating mainly in China, runs China's largest search-engine[19], owns multiple content, advertising and app services[20], and also leads the Apollo Project, a leading autonomous driving and AI project[21].

Streaming, mobile, and voice

Across the platforms, content is driving online experiences, from YouTube to Amazon Prime to Twitch, Spotify, Netflix and India's Hotstar. Gaming is growing, especially on mobile devices, and game-streaming services like Twitch respond to the 18 to 35-year-old gamer demographic, who tend to spend more time watching other people play video games than they do watching traditional sports on television[22]. In the UK, people already spend more leisure time online than they do watching television[23]. Streaming video and gaming on mobile devices is changing the usage and content viewing behaviours of mobile customers and is one of a number of drivers bringing about mergers in the communications, media, and content industries.

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> I think the world we live in now is too often one in which investment in start-up companies is geared towards reaching the point where they can be sold to one of the existing big players rather than grow into a big and independent enterprise itself. This is a challenge for me and for others because we grew up with an Internet where today's big company is going to be tomorrow's second tier.
>
> —Chris Riley, Director, Public Policy, Mozilla, Future Thinking, August 2018

Driven by content, mobile is estimated to account for more than half of all web traffic and is still growing[24]. Mobile apps are thriving, and expected to reach a total of 258 billion downloads valued at $157 billion (USD) in 2022[25]. Additionally, people are increasingly using voice to interact with devices and software, especially through the use of smart assistants and devices such as Amazon's Alexa, or Google Assistant, which powers Google Home, a smart-home Internet of Things (IoT) platform[26].

> "
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> Facebook was one of four companies (along with Google, Amazon, and Apple) that dominated the Internet; the combined value of their stock is larger than the G.D.P. of France.
>
> —The New Yorker, September 2018

Overall trends

Consolidation in markets at the application layer currently appears to be centred around a relatively small number of firms, predominantly from the US and China. Users and businesses benefit from this trend because they enjoy the convenience and markets that these platforms provide. The same companies are also expanding their operations into new markets through acquisitions and new product developments, further expanding their ownership to an even broader set of services that will shape users' Internet experience.

The Internet is growing and shrinking at the same time: users and traffic are both increasing, but most of the interactions are with a smaller number of dominant one-stop-shop players. This raises a question: How will the increase in time spent online, combined with the extension of the application layer into domestic and public life (e.g., smart homes), impact the Internet and its users?

Access Provision

Access to the Internet enables users to connect to information and communication technologies (ICTs) across the globe. **Physical access** is measured using metrics like availability, quality, and price of connectivity and services. Access and Internet adoption are both influenced by factors that are less easily measured and often deeply entrenched in societies, including levels of education (which tend to impact digital literacy skills), income levels (which impact the cost and affordability of broadband and devices), infrastructure development (especially in rural areas), the availability of relevant content (which impacts whether people want to gain access), and various cultural and structural factors which may impact adoption.

Supply side consolidation

To gain access to the Internet, users interact with providers on the supply side of access provision, chiefly mobile Internet or fixed broadband operators. National and regional circumstances vary greatly and have a significant impact on consolidation trends in the access layer in a specific region, making it difficult to identify a widespread trend of consolidation in the access market. But in certain markets, the access market is dominated by a small number of suppliers.[32][33] Where this is the case, such dominance tends to be driven by certain structural factors like high fixed costs and significant barriers to entry (often for regulatory reasons), which often means that providers need significant scale to become and remain commercially viable[34]. This need for economy of scale, encapsulating the ability to offer a lower price than that of most competitors, can naturally lead to consolidation. There is also evidence that some markets that were liberalised from historic governmental monopolies are again becoming consolidated, sometimes leading to higher prices[35].

Trends: Developed markets are experiencing a trend towards consolidation by dominant operators, with several instances of markets with 4 mobile operators moving to 3, via mergers[36]. Access providers face lower prices for data transport, a maturing subscriber base, competition between fixed and mobile that is driving down prices, and the erosion of voice and SMS revenues by Voice over IP (VoIP) or IP-based instant messaging (IM) services[37]. In response, some large access providers are moving into other layers by purchasing or allying with media, IT services, or software companies, and merging with other operators.

Some access providers are responding to the challenges of lower prices, infrastructure investment, and the erosion of revenues by sharing infrastructure[38]. Sharing towers, masts, and ducts can reduce costs, ensure coverage, and still promote competition[39]. This has proven successful in the highly regulated markets of the UK, Poland, and Romania[40]. Other responses include ventures into other businesses and layers, such as operators purchasing digital media, IT services, or software players with an eye toward vertically or horizontally expanding into sectors that could, over time, become parts of their core business[41].

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> With the mobile market in developed economies nearing saturation point, technology giants such as Google, Facebook and Amazon are turning to large and fast-growing markets in Asia and Africa…"We think the future of the internet looks like the next billion users," says Josh Woodward, a product manager at Google, whose team looks at future trends in smartphone use.
>
> —The Guardian, September 2018

Spectrum – cash cow or country enabler?

Mobile providers need allocations of radio spectrum to give users wireless access to the Internet. Access to affordable spectrum is therefore a foundational principle for ensuring access to ICTs and future network development; however, wireless access networks could be hampered, especially in

developing countries, by the lack of optimal and affordable spectrum[42].

When governments decide to use spectrum auctions to generate revenue, incumbents tend to prevail over potential new entrants.[43] This is at least partly because auctions often fail to attract new entrants into the market when reserve prices are set too high or when the amount of spectrum on offer is too limited.[44] In Ghana and Brazil, auctioned spectrum for 4G has gone to incumbents and market concentration has increased.[45] Governments, however, may deliberately incentivise the creation of new market entrants. In some cases, those new entrants may be purchased by incumbents further down the line.

Trends: Incumbent operators already had first-mover advantage by occupying the optimal parts of existing spectrum allocations. Instead of attracting new entrants to diversify markets, spectrum auctions may be helping dominant players gain even more market share by only making it feasible or attractive for them, and not for new entrants, to participate in competitive bids.

For many users, Facebook is the Internet

Three billion people are currently unconnected to the Internet, a little less than half of the world's population.[46] There are still significant gaps between developed and developing regions, urban and rural, men and women, wealthy and poor, young and elderly, and literate and illiterate people.[47] Quality, price and availability of both fixed and mobile broadband services vary greatly between countries and regions.[48] That said, some approaches to connecting the unconnected may risk locking users into current application platforms and exposing users only to a limited version of the Internet.[49]

Developed country users largely enjoy higher bandwidth, faster connections, and lower latency, thanks to peering between networks and locally hosted content.[50] While most developed countries have near-universal fixed networks to support the

widespread introduction of broadband, in Africa, for instance, fixed line networks reach barely 1% of the population.[51] Although the total number of mobile phone subscriptions globally is greater than the number of people on Earth, many people in developing countries still do not use a mobile phone.[52] And when the unconnected do gain access, such access may not be of adequate quality or low enough cost to be meaningful to them.[53]

> "
>
> This phenomenon is particularly evident, considering data recently released by the Brazilian Institute for Geography and Statistics (IBGE 2018), show-ing that the most popular activity among Brazilians Internet users is the utilisation of applications aimed at exchanging messages, such as WhatsApp and Facebook, with 94.5% of Brazilians stating that they use the Internet primarily for this purpose.
>
> —Regional panel input - FGV Brazil

> 78% of our survey respondents identifying as belonging to the "Business" stakeholder group agree that there is a trend of consolidation in the Internet Economy.

Providing access via a walled gardens of content gets users online and could drive demand for a wider range of what the Internet offers (i.e., outside walled gardens). For example, Facebook's Free Basics – a partnership with mobile network operators – gives users in more than 60 developing countries free access to content curated by Facebook, including news, employment, health, and local information.[54] But while these services are technically free, as no money is exchanged, users could be confined to one company's platform, as many users cannot afford the costs of accessing data from other services or are simply unaware that other services are available.[55] On the other hand, zero-rated initiatives can offer

useful ways of serving areas and populations that have traditionally been underserved for profitability reasons. A study conducted in Ghana, Kenya, Nigeria, and South Africa found that zero-rating cannot only provide a gateway to the Internet for first-time and price-sensitive users, but when the practice is adopted by non-dominant mobile network operators, zero-rating can enhance competition.[56]

Overall trends

To summarise, different market maturity levels, regulations, and institutions in each country significantly impact competitive market structures for access provision and how open they are to new entrants. These factors make it difficult to discern overall global trends of consolidation. Although national conditions vary, traditional access providers face pressure, particularly with the continued growth of mobile, a rising demand for data, and decreasing profit margins. In response, some operators share infrastructure, find ways to better use available spectrum, form strategic alliances and mergers and acquisitions, and seek higher returns in adjacent markets such as content and services. Examples of these actions include operators purchasing digital media, IT services or software players, with an eye toward vertically or horizontally expanding into sectors that could, over time, become parts of their core business.

At the same time, while platform-driven efforts to connect the unconnected are being driven by narrower interests than may be compatible with the porous and collaborative nature of the open Internet, the impact on local innovation and opportunity is unclear.

This raises questions about whether the access provision domain almost intrinsically tends to dominance due to the impact of economies of scale and other operating factors, and whether the entry of digital actors traditionally operating in other Internet domains (e.g., the app layer) might improve competition within 1 layer, while only entrenching their overall dominance cross-domain.

While the access markets differ considerably across the globe, to what degree will evolving access technologies bring the unconnected online faster? And, to what degree will the Internet platforms seek to gain a foothold in the access markets?

As the demand for streaming content grows around the globe, how will the networks that provide such services meet the bandwidth demands, particularly in those countries in which there are significant connectivity challenges?

Service Infrastructure

The Internet is a worldwide interconnection of computers in tens of thousands of networks run by diverse organisations. Its fundamental properties of collaboration, interoperability, permissionless Innovation, mutual agreement, and global reach make it possible for anyone who wants to be part of a network to simultaneously be part of the Internet as a whole. The open and decentralised nature of the Internet means that, in principle, anyone can set up a service at the edge of the network, which includes both the networks and devices within homes and enterprises, as well as the Internet service provider networks that connect those homes and enterprises to the global Internet.

Service Infrastructure describes the services and businesses that enable network participants to connect with each other to build and sustain the Internet. It includes specialised services like naming and addressing management, hosting and distribution of content, and the interconnection of the networks themselves. A number of the large platform companies are increasingly investing in cloud services and content delivery networks (Amazon Web Services) to undersea cables (Google), extending their reach from the application layer into the services and infrastructure layers.

"Do-it-yourself" transit?

Transit is how large communications providers interconnect to ensure data goes where it is needed around the world. The Internet depends on a fabric of business relationships that structure the exchange of data. For similarly sized networks, connectivity between them is often enabled via settlement-free peering, where no money is exchanged because the relationship has roughly equal value to both parties. Smaller networks must buy access to the global Internet from larger networks that market, sell, and operate transit service.

A small number of Tier 1 providers dominate the market for international transit. Every network that connects to the Internet is assigned an Autonomous System Number (ASN). Some of these Autonomous Systems (ASes) – usually very large networks – are known as Tier 1 providers. They do not need to buy transit from anyone else; rather, they sell it. A recent analysis of the interdependencies among ASes showed that a small group of Tier 1 providers play a significant role in connecting remote networks of the Internet.[61] The largest Tier 1 provider, Level 3, is estimated to serve nearly 53% of all ASNs in their customer cone.[62]

Trends: Although a small number of Tier 1 operators dominate global transit, there is a flattening of the Internet's hierarchy, as increasingly, networks interconnect via Internet Exchange Points (IXPs) and use Content Delivery Networks, thereby relying less on transit.

IXPs reduce access costs and latency by keeping more traffic local, and have seen significant growth in recent years, with the total number of IXPs increasing to 543 from 375 in the past 12 months.[63] Transit prices have been falling steadily, with some estimates indicating that global prices have decreased an average of 27% compounded annually between 2015 and 2018.[64]

These market trends are reinforced by the continued growth of Content Delivery Networks (CDNs) and large content providers investing in their own infrastructure for international connectivity. Google, for example, has laid its own oceanic submarine cables.[65]

Overall, transit providers are under pressure from several directions. As IXPs keep more traffic local, economic and performance considerations will favour peering and non-monetised arrangements over transit arrangements. The evolution of CDNs using private networks to distribute content internationally also helps drive down demand for transit. Diminishing profitability of transit service provision may drive acquisitions and mergers intended to increase scale and reduce costs.

Content Providers' Submarine Cables
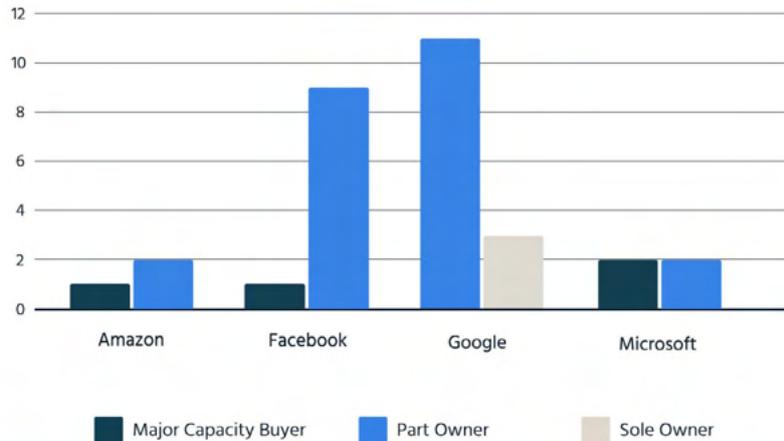
Data from TeleGeography[66]

Content Delivery Networks (CDNs) – local hosting, global brands

CDNs are specialised networks of servers designed to cache and serve content in geographically diverse locations closer to the user. They store a copy of the content (e.g., cloud storage capacity or popular films) close to the edge of the network serving the content consumer. CDNs can increase reliability, reduce latency and also reduce demand for transit.

Trends: CDNs are now a fundamental infrastructure component for building high-performance, reliable web services. Some big content providers even operate their own CDNs (e.g., Netflix Open Connect[67]). Among the top 1,000 websites globally, CDN use grew to an estimated 87.5% in August 2018 from 50% in June 2014. Of the websites in the sample that use CDNs, 27% use Amazon Cloudfront and 27% use Akamai. While some content providers make use of multiple CDN providers, the fact that 474 of the top 1,000 global websites use one of these 2 CDN providers indicates that they have significant market share.[68]

Beyond the top 2 players, companies such as Microsoft and Alibaba are expanding their own CDN services, both organically and through acquisitions. Similarly, Alibaba is now estimated to have one of the largest CDNs in China after acquiring the online video platform Youku in 2016.[70]

Cloud computing grows; as does big players' market share

With the ability to access and manage servers remotely, from anywhere on the Internet, new businesses have emerged that specialise in renting out space and processing on their servers. Today, cloud computing services dominate this arena. They use large data-centres with expertise and economies of scale, offering their specialised services globally. Customers tend to access these resources as needed instead of buying and managing servers themselves.

Cloud computing essentially means the delivery of computing and storage services over the Internet, with companies offering these services called cloud providers. These providers offer functions as a service. These are functions to rent, including Infrastructure as a Service (IaaS), Platform as a

Alexa Top 1k-2018
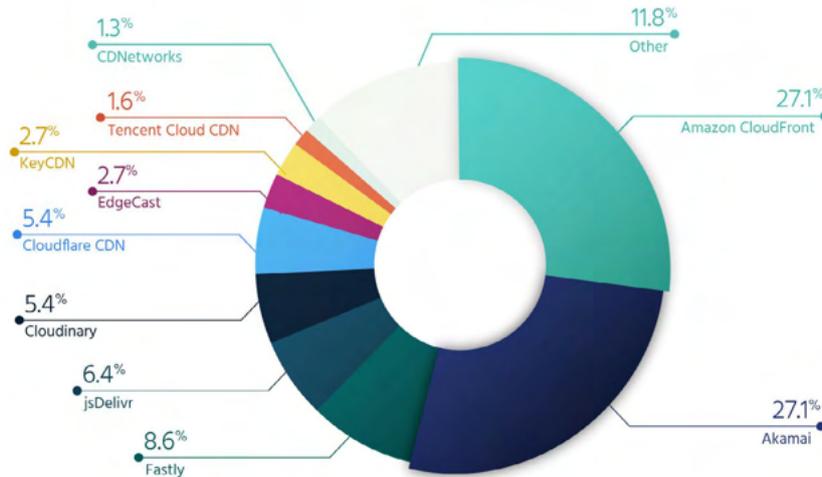
SOURCE: Datanyze. As of August 2018. Datanyze chart of Content Delivery Networks, Alexa top 1k for 2018. Available at: https://www.datanyze.com/market-share/cdn/Alexa%20top%201K/

Datanyze
A ZOOMINFO COMPANY

Source: Datanyze[69]

Service (PaaS), and Software as a Service (SaaS). IaaS customers outsource basic computing requirements, such as processing and storage, to cloud providers, but manage everything else themselves, from operating systems to deploying applications PaaS providers offer additional elements of the technological stack, including operating systems and functions like development tools, database management, and analytics. Large providers may even offer AI/machine-learning capabilities such as natural language-processing and image recognition[71], for instance. SaaS, in turn, largely covers applications discussed in Section 1.1 on Applications and Services.

Trends: Cloud computing is growing fast. The market for cloud computing services like IaaS and PaaS is expected to almost triple to $110.8 billion in 2021 from $41.9 billion in 2016.[72] The IaaS market has long been dominated by Amazon Web Services (AWS), with Gartner estimating AWS's global market share of IaaS to be 51.8% in 2018.[73] The IaaS market now appears to be consolidating around a small set of large providers: AWS, Microsoft, Google, IBM and Alibaba.[74] The current top 10 providers are expected to increase their market share even further, to 70% from 50%, by 2021.[75]

The market for PaaS features the same players – AWS, Microsoft, Google, IBM and Alibaba – but also includes established companies like Oracle and Salesforce. As large investments are required in order to provide the full range of capabilities and resources, the IaaS and PaaS markets appear to be consolidating around the major players.

DNS services – growing concentration on all sides

The Domain Name System (DNS) translates reader-friendly domain names (e.g., example.com) into numeric Internet Protocol (IP) addresses. The DNS comprises many actors and functions, including registries, registrars, and root zone operators, but we focus here on two functions: recursive DNS and DNS hosting services. In both areas, we see trends of concentration towards a smaller set of global providers.

Recursive DNS services

Recursive DNS servers perform an IP address lookup in the DNS on the user's behalf. They have traditionally been supplied by the user's Internet Service Provider (ISP), but now new options

are available, with public recursive DNS servers, available to anyone, increasingly being used. ISPs and enterprise administrators can outsource recursive DNS service to one of these public servers. Tech-savvy individuals may also choose to configure their devices to make use of public DNS servers, for example, to circumvent a local DNS-based censorship regime.[76]

Trends: Since Google entered the market with 8.8.8.8, several other public recursive DNS providers have emerged (e.g., Cloudflare's 1.1.1.1 and Quad9). Google's public DNS is still considered the largest among these services, with estimates from APNIC indicating that nearly 15% of all Internet users rely on the service.[77]

40% of our survey respondents see consolidation being a global trend, while 26.5% see it as more visible in certain countries.

DNS hosting services

Dedicated DNS hosting services are typically used either as part of a bundle of hosting services offered to smaller websites and individuals, or as more specialised DNS hosting providers used by large content providers and businesses, as well as cloud service providers with high-traffic domains, which need to avoid costly website downtime. CDNs use the DNS to direct traffic to content instances in order to improve reliability and latency for content providers.

Trends: A study of the top 1,000 domains using .com, .net and, .org indicates a trend towards consolidation in the DNS space with 4 providers: Dyn, Akamai, AWS, and Cloudflare. These providers had an estimated combined market share of 50% in May 2017.[78] This is being driven both by the move away from self-hosting and toward cloud-based site-hosting and management platforms, which use the DNS for traffic engineering purposes, and also by consolidation in the broader hosting market. While

website owners may benefit from vertical bundling of services and access to expertise, bundling also potentially impacts DNS diversity as single points of failure can reduce overall network resilience in the event of outages or other service failures. Single points of failure can similarly be exploited in attacks, such as the 2016 DDoS attack against Dyn.[79]

Overall trends

Transit is changing in ways that can reduce demand for traditional Tier 1 international transit. As IXPs are more widely used, CDN use grows and data is stored closer to users, and large platforms build their own infrastructure. Price pressure in international transit may drive market consolidation amongst Tier 1 providers as they try to deal with lower margins and the ongoing need for infrastructure investment. The changes to transit are mostly driven by developments in other areas of service infrastructure, particularly CDN and cloud-computing. These, in turn, are driven largely by the growth and investment by major Internet platforms and technology companies.

A small number of players in different parts of the technology stack increasingly dominate service infrastructure. The decentralised nature of the Internet is changing, and at some levels, more concentrated arrangements are beginning to emerge, particularly in DNS services and CDNs.

This changing topology of the Internet raises a number of critical questions:

What is the benefit or impact, if any, for competition and the open and interoperable Internet when the Internet platforms secure a significant presence across the application and services layers?

Does the flattening of the Internet change the fundamental characteristics of the global infrastructure – and in particular those of global reach and integrity, and interoperability and mutual agreement?

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6

Takeaways & Observations

Key Features of the Consolidation of the Internet Economy

This section looks more closely at some of the features of the consolidation of the Internet economy. We uncovered 5 key features during the course of the research, which raised a broad span of issues, including how consolidation might shape the user experience, its impact on innovation, to how governmental or other stakeholders might respond to it. While not exhaustive, the list of considerations below helps us understand how consolidation trends in the future might impact the Internet and its users.

Total Service Environments

Summary

- Many Internet platforms are expanding into new service and content areas, both to retain customers and to continue to grow revenues.

- Total service environments for business and innovators operate at a scale that will allow entrepreneurs to do things they couldn't otherwise. This includes accessing a much larger customer base, as well as resources and expertise that no small business could tap on its own with limited resources or time.

- Platform environments unleash huge opportunities, but because innovation and entrepreneurship remain within the platform, competition to the dominant players will effectively be neutered.

Total service environments; the convenience of a one-stop shop

While some companies dominate their original markets such as search, e-commerce, and messaging, their increasingly diversified service offerings are overlapping and starting to compete in other markets. Search-oriented Google, for example, is trying to capture more of e-commerce, as is Facebook. The consumer-to-consumer Facebook Marketplace competes with eBay. Similarly, Google and Amazon compete for the smart home and smart device market, along with Samsung and Apple.

At the same time, how people spend their time when using the Internet is evolving. For instance, in some regions, young people may be spending less time on social media and more on and gaming platforms.[1] As they expand their reach and services, many platforms will compete with each other more directly, trying to leverage their dominance in one service or application space to quickly build a presence in another.

In content provision, as it is broadly defined, Internet platforms and telecommunications and media players such as AT&T/Time Warner are likely to work hard to retain and grow their customer bases, offering increasingly tailored content and services to meet their users' demands for content. Many Internet platforms compete with each other and with the traditional media players: from Google's YouTube, to Amazon's Prime and studio offerings, to Facebook's Facebook Watch, Disney, Oath, and Netflix, alongside telecommunications/content licensing deals such as India's Eros and China's iQIYI,[2] Alibaba's Tmall Box Office,[3] Safaricom's Iflix partnership,[4] and numerous Over-the-Top (OTT) Video on Demand partnerships all over the world.

In China, the Alibaba consumer-focused financial spin-off Ant does everything from mobile payments to life insurance, credit, investments, and savings. For many of its users, it has become a financial one-stop shop.[5] WeChat, the original "app for everything," focuses on "everything from point-of-sale purchases to accessing public services – (and) is likely the template that other social platforms around the world will emulate as they strive for more thorough integration with their users' lives."[6] WeChat is owned by Tencent, whose platforms, which include WeChat/Weixin, QQ, Qzone, Tencent Video, and Tencent News, capture more than 55% of Chinese consumers' mobile Internet usage.[7] Tencent provides a one-stop shop with everything from "social networking to gaming, digital assistants, mobile payments, cloud storage, education, live streaming, sports, movies, and artificial intelligence".[8]

With the evolution and proliferation of IoT and technologies like voice-controlled devices, these total service environments are intertwining more with our physical lives. Our homes, cars, roads, hospitals, and more will form greater connected ecosystems as ubiquitous computing and networking evolve. Users may choose the platform's own offerings over niche providers because one-stop shops can provide a better and more convenient service, driven by scale and pooled resources.

Choice by default

The success of a total service environment is the consequence of the ability to provide a range of services that users believe or know they need. Much of this success is driven by convenience and by providing easy access to useful and targeted products and services. Platforms grow ever more "sticky, understood as their ability to retain users, with AI-tailored hyper-personalised services and business strategies that seek to capture the users of today and tomorrow.

Platform stickiness is driven by the idea of default: users often stay with a search engine, social media

Footnote References for Section 6 of the report are listed on pages 55–57.

platform, or cloud-based business services because it's convenient or because of necessity. Becoming a default platform increases the potential of retaining users for longer periods of time, which means the platform can gather ever more data to be used for targeted advertisement and further improving the service. This path towards becoming the default provider occurs through different ways, and largely by design:

- Default options on devices or in software might not seem difficult to change for many Internet users, but many users will refrain from taking the extra effort needed to figure out how to switch. But remaining with a particular platform reinforces that platform's dominance. Google is the default search for Apple's Safari, Mozilla's Firefox (replacing Yahoo), and the Siri smart assistant. Google is also the default search service on the Android mobile operating system and platform. Google developed Android and it is now used in more than 86% of mobile phones around the world.[9] Applications having Google as the default search engine reinforces its dominance and drives its advertising revenues.

- The popularity of smart voice assistant devices means there's less of a need for people to use a smartphone or computer or use a particular service to buy something online. One can simply speak out loud and the service-provider's fulfilment centre instantly takes an order. If users don't adjust the settings and ask for a specific music service on an Amazon Echo, for example, it will automatically use Amazon's own music service.[10]

This strategy of default and nudging users to one's own products is not new, but it illustrates the power inherent in controlling the platform through which other services and products are accessed. With the evolution of more personalised services powered by personal data that can anticipate our needs, this power of default will become even more important. For the user, it can have great advantages, but it can also impact competition and choice in ways that will become more pronounced in the future.

As the platforms expand, they acquire companies that might have become a future competitor: the largest US tech platforms have acquired hundreds of start-ups in the last 10 years.[11] Customers moving from one service to another, although somewhat different, may merely be moving to a differently branded service of the same platform:

- Customers of Facebook's Messenger may decide to move to the instant messaging app WhatsApp and younger people are leaving Facebook — or just not joining it— in some regions, and using Instagram instead.[12] But Facebook owns both WhatsApp and Instagram. Similarly, China's Tencent owns both the original QQ social network, Qzone, and the WeChat platform.[13]

- In the world of online travel agents, choice is more apparent than real. Priceline, a $98 billion USD company, owns Booking.com, Kayak.com, and RentalCars.com. Expedia ($23 billion USD) owns Hotels.com, Travelocity, and Orbitz.[14]

- Big platforms also use their financial power to expand geographically through acquisition. Alibaba acquired Indonesian online retailers, Tokopedia and Lazada,[15] and Amazon purchased in 2017 the biggest online retailer in the Middle East, souq.com.[16]

These types of acquisitions have led some tech investors to claim there is a kill zone around the top 5 American technology platforms. This kill zone lessens the incentives for investors to look for potential competitors to the dominant platforms, undermines competition generally, and leads to the ossification of the market through the perpetuation of the one-stop shop and default service. Ultimately, the kill zone enables the continued dominance of the current players.[17]

Total service environments are becoming *de facto* platforms for new and evolving businesses

Total service environments extend both vertically and horizontally to serve the ever-growing range of needs of business users and technological innovators. Amazon provides cloud services through its Amazon Web Services (AWS), as does Microsoft through Microsoft Azure. Google extends through its own cloud offerings and content delivery network services (CDNs). Beyond servicing large companies and government agencies, these services offer small and emerging businesses and innovators compelling access to infrastructure and expertise, along with functionality.

The ambition of the large Internet platforms does not stop there. Through digital assistants, drones, connected cars, smart homes, and smart cities – all underpinned by increasingly sophisticated AI — they are building their capacity across multiple domains, securing the footprint and developing a range of services to ensure that they remain the preferred total service environments of the future.

Platforms strive to keep innovation within their services ecosystems. The recent product launches from Amazon at their re:Invent 2018 conference[18] provide several examples of this dynamic at work. The larger platforms recognise that capturing innovation within their platforms not only drives their own functionality and popularity, but also identifies and channels innovations that have the potential to be disruptive and competitive. While platform driven APIs and SDKs provide great opportunity and access to markets for developers, they also help ensure that future content, gaming, and other services remain mostly within the platform.

The trend towards a total service environment is an attractive choice for many businesses and innovators. The savings and operational benefits that accompany the services of a single provider, from productivity suites to cloud services and the ability to outsource business infrastructure and services, are considerable. But at the same time, outsourcing to a single provider builds a dependency on the platform offering the services, creating a potential lock-in and vulnerability to business and systems-wide cyber threats. A recent debate around whether the US Department of Defense should use a single cloud services provider highlights concerns related to adopting a single-vendor solution.[19]

AI, the competitive frontier

AI will be an important element for online businesses in the next decade, including data-driven platforms' ability to attract and retain users, as it enables platforms to provide users and business customers with more value by continuously tailoring responsive products and services. Scale – and related access to data and resources – may be key to unlocking AI and maintaining platform "stickiness" to keep users in one-stop shops indefinitely. Examples of how AI is currently being pursued to attain a competitive edge include:

- Google, Amazon, and other large companies are acquiring AI start-ups[20] and are competing to recruit new talented researchers.[21]

- Big cloud platforms like AWS, Google, Microsoft, and Alibaba readily offer AI capabilities to developers, which may also tie future innovation to those platforms.[22]

- China's Ministry of Science and Technology has set out a detailed national strategy[23] and identified its 3 consumer-focused tech giants, Baidu, Alibaba, and Tencent, as the national team to dominate AI globally by 2030.[24]

Are one-stop shops inevitable?

Most users can benefit from the tremendous convenience, versatility, and deep wealth of offerings of the one-stop shops. It is usually much easier to navigate within an environment of services provided by 1 player than to find everything we want or need independently. With the move to voice-controlled devices our interactions will become even smoother. That said, one-stop shops could also constrain the potential for new market entrants, limiting the opportunity and impact of disruptive innovation outside of the proprietary platform environments.

A question arises at this stage: Is the one-stop shop inevitable, or is there a path towards an Internet economy in which there's a greater diversity of players that are more competitive and innovative?
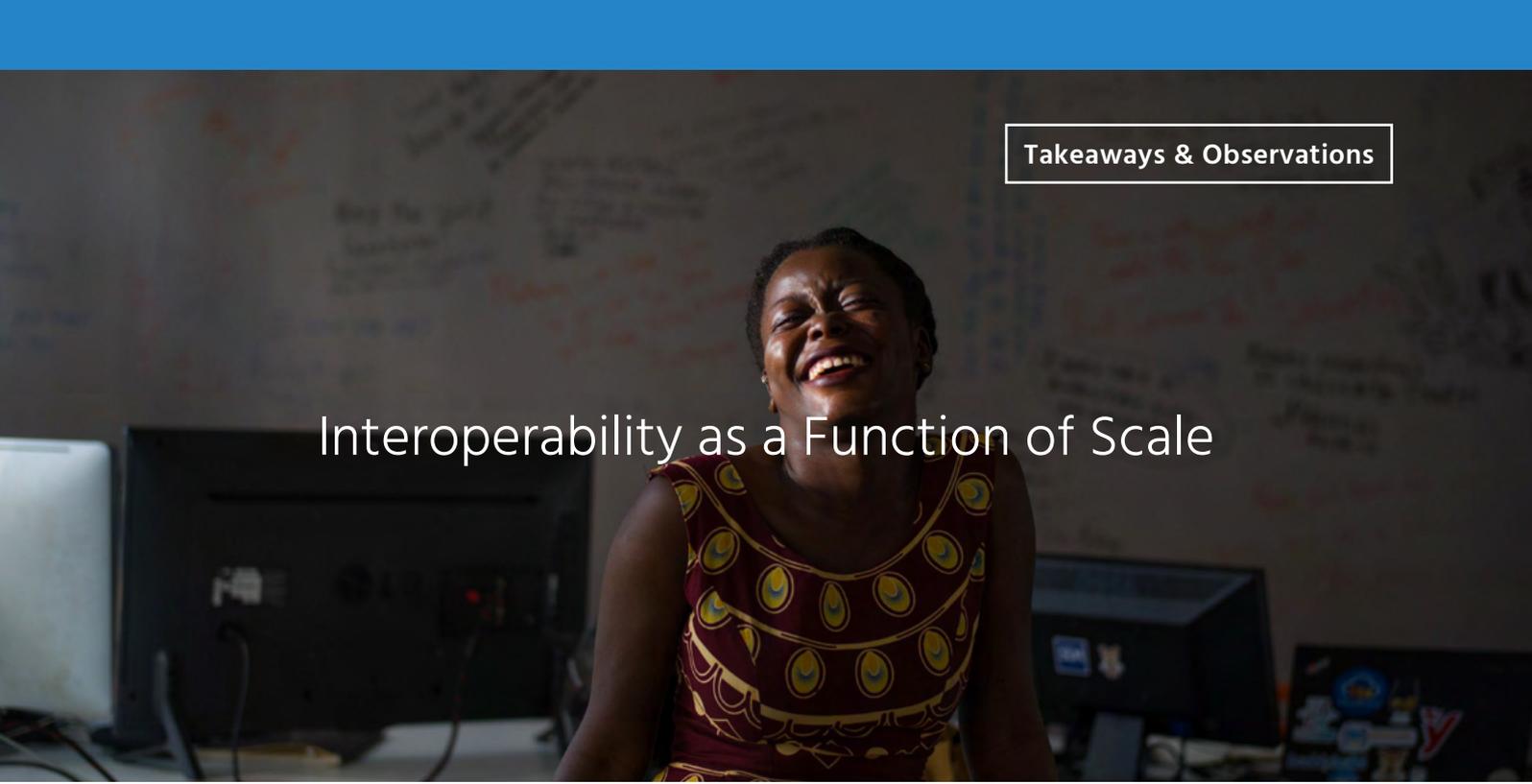
Interoperability as a Function of Scale

Summary

- The nature of an open, collaborative, and interoperable Internet is influenced by a small number of large companies, where organisational scale and market share play a significant role in the development and deployment of the open technical standards on which the Internet depends.

- Large organisations can accelerate the adoption of existing but under-deployed standards like IPv6 and push the development and testing of new standards, benefitting the Internet as a whole.

- The growing use of APIs puts more of the Internet's innovation, functionality, and interoperability into the hands of the dominant Internet platforms, whose interests may not always align with those of the broader technical community and other players.

- Future innovation, services, and applications may depend on the availability of a small set of proprietary platforms and services, rendering those applications less resilient, reliable, and capable of supporting further innovation.

A dumb network

The Internet's architecture is unusual because of the nature of "inter-nets": they are networks of networks, and the Internet spans the whole world. Because each network operates autonomously, (hence "Autonomous System"), there is no central authority to determine what a network might or might not do. But to make each node in each network operate tolerably with other nodes (nodes that might be in other networks), we need common protocols. It emerged that the best way to operate in such an environment is to place as much functionality as close as is practical to the "end" of communication;[25] sometimes called the "end-to-end" architecture.

It is also sometimes called the smart endpoint design, and distinguished from the smart network design typical of the traditional telephone network: in the former, most of the ability to work with the network resides at the endpoint (with the network basically just carrying messages). In the latter, the ability to work with the rest of the network resides in the middle of the network, and the end points are dumb clients, which means that their functionality is fully dependent on connecting to a central server. The end-to-end architecture is one of the key enablers of the development of the Internet economy over the past 3 decades.

Another feature of the Internet's technical architecture is its independence from pre-existing contractual relationships among all parties. Any party using the Internet can talk to any other party, without permission from intermediary networks, as long as each conforms to the relevant protocols for the network's intercommunication. Combined with a smart endpoint design, this architecture enables permissionless innovation, because nobody else on the Internet needs to change anything in order that 2 end points use some new network application.

Just as shared languages enable people to cooperate, build communities and exchange ideas, the use of open and globally interoperable protocols has enabled the Internet to grow into the network of networks it is today.

However, the impact of a consolidating Internet economy on the development and deployment of protocols for interoperability indicates that scale is not just a source of efficiency, but also a source of power.

> 84% of our survey respondents identifying as "Technical Community" had noticed larger players in the Internet Economy increasingly influencing standardization for networking, technology, software, and interoperability.

Scale drives the adoption of standards

Open standards are the basis of the Internet's success, but adoption requires investment, which can result in sluggish take-up. While many agree that IPv6 is important and beneficial to the Internet as a whole, individual organisations have hesitated to invest in the hardware, technical expertise, and possible changes to network operations that are required. Without a significant deployment of IPv6 in the Internet overall, there have been fewer incentives to adopt it because the benefits were seemingly outweighed by the costs of dual-stack deployment.[26]

Large organisations, including network operators and content providers, have addressed this challenge, adopting IPv6 in a coordinated way.[27] Since the World IPv6 Launch began in mid-2012, IPv6-enabled connections from Internet users to Google services have increased from less than 1% to more than 25%.[28] While it is difficult to determine exactly how much of that growth was stimulated by the intentional movement of very large organisations, or whether growth was inevitable due to IPv4 shortages, the effect has been significant. Since at least mid-2012, several major operators now

deliver the majority of traffic from major content sources like Google, Akamai, and others over IPv6.[29]

In addition to directly adopting a particular standard themselves, big players can also nudge others to adopt standards that benefit the Internet as a whole. Google displays a "Not Secure" warning in the Chrome browser's address bar if a user connects to an unencrypted website, incentivizing websites to use HTTPS[30]. In a similar push to service providers to do the right thing, Apple requires all apps on its iOS AppStore to be IPv6 compatible.

Scale and market share therefore imply that when big players in the Internet economy decide to support a new standard, they can accelerate and spread its adoption and ultimately change the incentives for others to do the same.

Scale drives standards development, too

In a network of networks, there is no centre of control because there is no centre: each network does what it wishes according to local needs. As such, there is no way to impose a common standard. It is only possible to invite participation in a standard protocol according to the wants and needs of others. The inter-network's participants therefore use an open standards development process to reach consensus on communication protocols.[31] Because expertise and resources are necessary for people to engage effectively in standards processes, large corporations, universities, and other influential organisations have always played prominent roles. Competitive markets that exist outside the standards process has generally meant that the interest of particular businesses in influencing particular protocols was offset by rivals. But just as scale is important for deploying standards, it is also an important and growing factor in developing standards, too.

HTTP/3 is a new protocol based on QUIC, a protocol initially developed by Google, and now under consideration for standardisation by the IETF. HTTP/3

reduces the time for establishing a connection for IP traffic without compromising security, and has the potential to benefit the Internet as a whole. Google's role in originating the protocol was enabled by its significant resources and expertise. The company's enormous size allowed it to test QUIC on a global scale using its browser, Chrome, and its servers for popular services including YouTube. The fact that it controls both the browser platform and the service being delivered is a tremendous benefit in analyzing Internet usage and experimenting, developing, testing, and deploying potential improvements. However, it is also an example of how its significant browser and content provisioning market share provides it with unique resources that few can match.

An example of how 2 companies could change the dynamic of a bigger technical ecosystem is "DNS over HTTPS" (DoH). Mozilla is championing DoH, a protocol for doing DNS resolution via HTTPS[32], and testing it in partnership with Cloudflare.[33] DNS data can be sensitive from a privacy perspective and DoH seeks to improve user privacy by encrypting DNS requests using HTTPS. On the one hand, this development appears increase the privacy of user data. On the other, it would be possible for a web browser to select a single DoH provider as the default option to handle all requests. In that case, it would concentrate a great deal of information about that browser's users under the control of a single DoH provider. This might happen without user intervention, and if it happened in a web browser with large market penetration it could change the effective privacy properties of a large fraction of global DNS requests, while changing the trust model of the DNS itself.

APIs can operate less like the Internet and more like a monolithic system

New services and applications on the Internet increasingly depend on their ability to interoperate with third-party services made available through an

Interoperability as a Function of Scale

application programming interface, or API. A public API is an interface to functionality of a third-party service. APIs intended for use in this fashion are publicly specified, (e.g., the Google Street View API[34]).

In some ways, network protocols and APIs are similar, but there is an important difference. A protocol must be agreed to by everyone who uses it. An API is under the control of the entity that owns the "A": the application with which one interfaces.

On the Internet, APIs have implications for change control. In an open standard, the interested community has a say about changes to the interface defined by the standard. APIs can be made publicly available, (e.g., by publishing the specifications for use), but unilateral control of changes always remains in the hands of the application owner who publishes the API. Greater dependence on an API for Internet-facing functions may therefore entail greater control by the API owner as to what is possible on the Internet, as well as a corresponding reduction in the reliance on open protocols.

Will new protocols, standards, or practices championed by large organisations have positive effects for all or only some?

New protocols, standards, or practices championed by influential organisations could have significant effects. Some impacts could be positive, such as overcoming market failure in adoption and the ability to widely test protocols before full deployment. But others may be negative. This evolution might benefit small numbers of players or concentrate traffic flows, with possible adverse effects on competition or even privacy. While the Internet may benefit from specific developments, the ability of small numbers of huge organisations to be benevolent rule-makers while everyone else is a

rule-taker could concentrate power on or over the Internet.

Interoperability has been fundamental to how the Internet has evolved and why its many uses and innovations have flourished. But while the Internet will continue to enable new and interoperable services and applications in the future, innovation might be concentrated where value is readily available, on a small set of proprietary platforms. Are users locked into 1 or 2 platforms really benefiting from all the opportunities the Internet has to offer, or are they merely using the Internet for transport?

This evolution raises several questions: Will new protocols, standards, or practices championed by especially large organisations have positive effects for all or only some? How will concentration affect the development of standard and non-standard protocols on the Internet?

> "
>
> The Internet was envisioned as a decentralised network which facilitates communication between two endpoints. However, a discussant pointed out that the landscape of network traffic is wholly different now: video streaming makes up a significant chunk of the traffic now, with Cisco estimating the 80% of the Internet Protocol traffic will be video by 2021.[96] Since video hosting is dominated by a few companies such as Youtube, Netflix, and Facebook, there has been an emergence of "super-nodes" in the Internet. This has been followed by a concerted effort to be efficient at meeting such consumers' needs, which further contributes to changing the network topology. For example, several companies employ edge caches at various Internet Service Providers (ISPs) to optimise user performance.
>
> —Regional panel report, The Centre for Internet and Society, India

A Changing Internet Topology

Summary

- The ability of a small number of content and cloud services to invest in their own networks and deploy their servers close to the broadband network edge is amplifying the existing trend of a flattening Internet, where access networks are increasingly interconnected and have less need for international transit.

- Access networks are evolving rapidly, driven by the Internet of Things (IoT) deployments and other demands for processing on a range of user devices, including evolving technologies such as autonomous vehicles.

- Big cloud providers like Amazon, Alibaba, Google, and Microsoft are well-placed to dominate the new era of IoT and edge computing, further driving a changed Internet topology with less international transit and more complex, private, specialised networks and services. This could come at the cost of the general-purpose Internet.

A flattening Internet

As access networks increase their interconnectedness and the need for transit decreases, the Internet's topology is flattening. Geoff Huston, Chief Scientist at APNIC,[35] calls this "the death of transit."[36] He is describing how the current, denser mesh of access networks is driven by Internet Exchange Points (IXPs) that facilitate peering arrangements, as well as the ability of access networks to peer directly with content delivery networks (CDNs). This flattening will continue as activity to develop access networks intensifies to facilitate IoT deployments and the processing of real-time applications.

Flattening is not an inherent consequence of consolidation trends, but is strengthened and shaped by a small group of content and cloud providers with the ability to deploy content delivery caches globally. Caches, in turn, become more effective and useful by the increasing numbers of IXPs, which tend to interconnect access networks and concentrate the points where transit needs to be provided.

67% of our survey respondents expect consolidation to significantly shape the evolution of the Internet in the next five years.

Used International Bandwidth by Source, 2002-2017
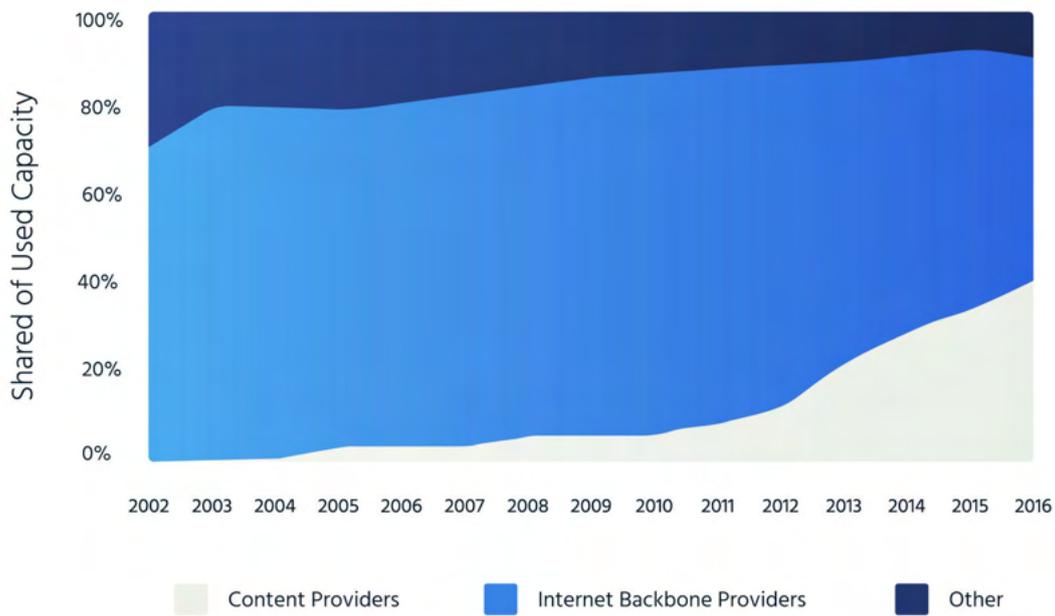
Content Providers   Internet Backbone Providers   Other

A global network of data centres

As we saw in the previous section, large content and cloud providers are investing in their own international connectivity infrastructure to serve their networks of data centres and servers across the globe. TeleGeography estimates that the capacity deployed by a small set of content providers is growing faster than all other customers of international bandwidth and may become the largest share of used international bandwidth as Internet backbone providers' share decreases.[37]

Underpinning the trend of content and cloud providers investing in their own infrastructure is the dominance of a small set of providers in the application layer, predominantly Google, Facebook, Amazon, and Microsoft. Their services rely on a global network of interconnected data centres and servers to process and deliver content closer to the users.[38] With the exception of Facebook, these providers are also competing in the market for cloud computing. Having a large customer base in the application layer supports investment in infrastructure to serve both those customers and users of service infrastructure.

Infrastructure investments by the large platforms are being driven by ever-increasing traffic between their data centres as cloud-based applications and services continue to grow. Cisco estimates that global traffic between data centres will grow by 32.7% annually between 2016 and 2021, a higher growth rate than the traffic between data centres and the users, which is projected at 25.2%.[39] This trend has been driven by CDNs and the need to disseminate large volumes of static content closer to the user, such as images and video. In the near future, however, evolving services where processing moves closer to the end user or device will likely dominate traffic growth.

> " In the digital networking world, we are seeing more and more data traffic go 'dark'. Content service operators are using their own transmission systems or slicing out entire wavelengths from the physical cable plant. This withdrawal of traffic from the shared public communications platform is now not only commonplace, but the limited visibility we have into this activity suggests that even today the private network traffic vastly overwhelms the volume of traffic on the public Internet. And the growth trends in the private data realm also is far greater than growth rates in the public Internet.
>
> — Geoff Huston, RIPE NCC, December 2018

An evolving edge

Access networks and access devices — the edge of the Internet — evolve rapidly, with many and varied devices connecting to new services, potentially using specialised networks, driven in large part by the IoT. 5G cellular network standardisation and deployment are partially driven by anticipated uses that depend on bespoke access networks with much greater processing capabilities in base stations close to mobile terminals. It is not yet clear how much of the 5G vision will be realised in practice, but it is at least possible that 5G deployments will increase the tendency for access network specialisation and the growth of edge computing. Of course, neither of these tendencies form part of an Internet approach to networking.

Some processing is better done on the device or at data centres closer to the user. Facial recognition in Apple's recent iPhone X is processed on the device and not performed in the cloud.[40] Some applications dependent on AI and machine learning need to be trained on data from local environments. In most cases, however, speed is a key concern. Real-time applications such as self-driving cars cannot afford

the time it takes to have decisions processed in the cloud.

The evolution of edge computing is not a substitute for cloud computing in large data-centres, but rather a complement that facilitates the needs of some applications to use both types of computing resources. While some applications powered by AI need edge processing to make inferences on the device, they still rely on data models trained with the cloud's abundant processing power and enormous amounts of data.

While the evolving edge of the Internet is a new frontier that could see new entrants, large cloud providers like Amazon, Alibaba, Google, and Microsoft may be in a favourable position to dominate the new era of IoT and edge computing. Ownership of the underlying infrastructure is one advantage, as is provisioning the platforms for the development of new applications. Microsoft's new slogan, "intelligent cloud, intelligent edge"[41] is an attempt to capture this trend. Services like Amazon Greengrass,[42] or Google Cloud IoT Edge,[43] are all intended to support developers to deploy new applications that require processing in access networks. Google has even launched a new chip, the Edge TPU, which is specifically designed to optimise machine-learning inference on the edge computing device itself.[44]

Will the deployment of new infrastructure support the general-purpose Internet for everyone?

The trend of localizing content, and the growing complexity of specialised networks and purpose-built services, will drive the Internet topology towards a more densely connected mesh. This trend towards a more densely connected network has in the past been positive in how it improved the delivery of content, and reduced overall traffic costs. But we must consider how the continued flattening

of the Internet disrupts economic models of the past.

Several questions arise: Will traffic in access networks be driven by large content and cloud providers feeding their localised infrastructures via private networks? Does this mean that a smaller player, depending on transit and therefore subject to longer latency, will necessarily lose out? Will the deployment of new infrastructure support the general-purpose Internet for everyone, or could the Internet fade into the background as the evolving edge is captured by a small set of private networks and services designed for a few operators?

61% of our survey respondents said consolidation is likely to impact the scale and severity of cyberattacks and cybercrime in the next five years.
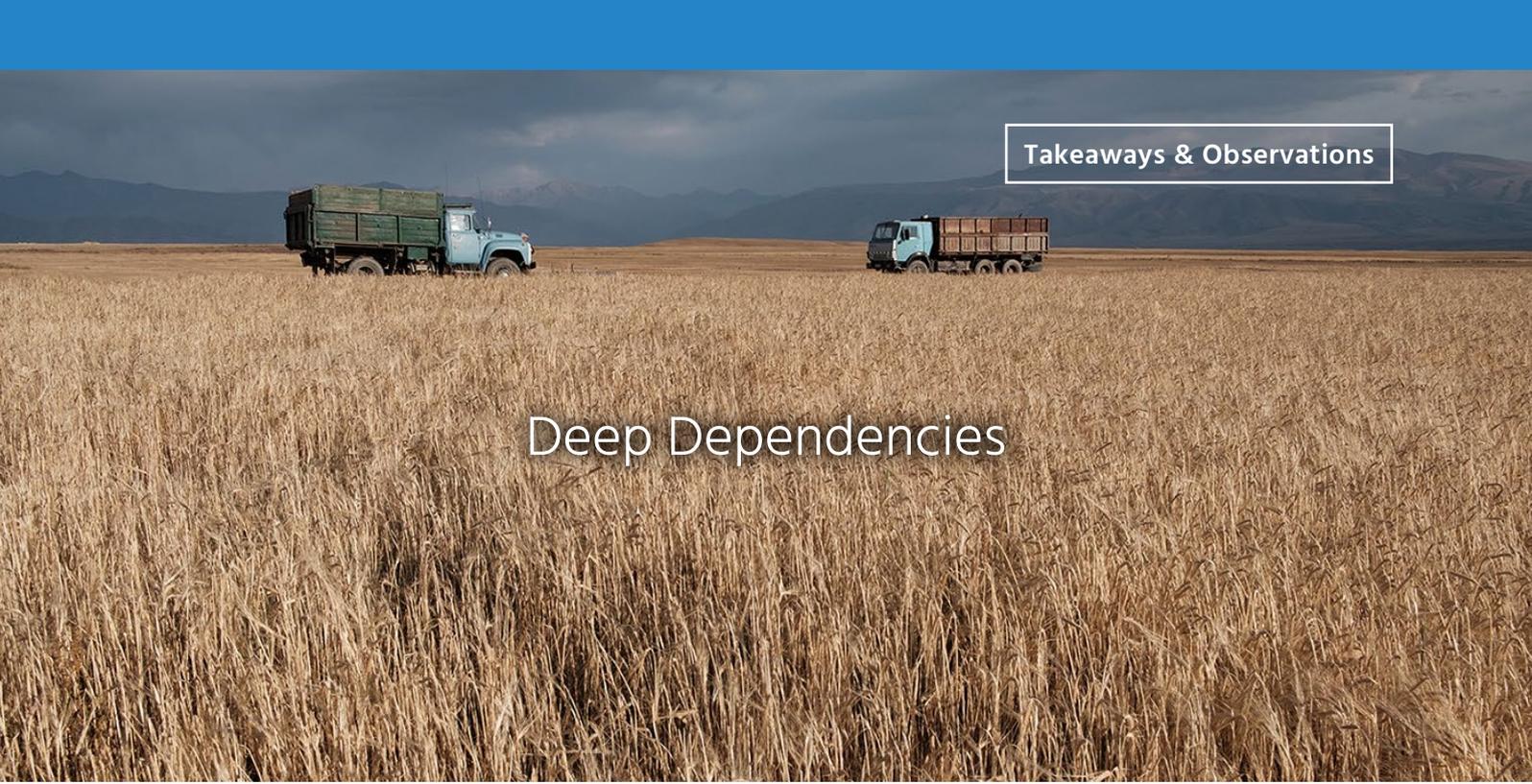
Deep Dependencies

Summary

- Central to the Internet's success has been its ability to evolve, as captured by the characteristic of "no permanent favorites" where no specific company or technology is above disruption, evolution and competition. This characteristic could be challenged as dependencies continue to grow.

- The development of new applications, services, and businesses across the global economy is increasingly dependent on a small number of private platforms owned by the largest Internet companies. While the risk of catastrophic failure may be very low, consequences of failure could create a domino effect for other parts of the global economy.

- As platform environments expand further, entering and often dominating more sectors and markets, combined with an exceptional economic power, there is a risk of growing societal dependencies on a handful of powerful economic actors.

The largest Internet platforms are expanding horizontally from dominance in their core areas — search, social, operating systems, e-commerce — into new economic sectors like health, automobiles, or even urban infrastructure. While the success of such horizontal expansion remains to be seen, these companies are also expanding vertically, through the application, infrastructure, and access domains of the Internet economy.

Governments rely on these companies for service procurement, and at least one, Alphabet, has a stated goal to improve traditionally public services.[45] If this trend continues, future societies may become dependent on a small number of companies providing much of the backbone for daily life and becoming too big to fail.

"Too big to fail" is what happens when the potential consequences of a single organisation's failure are so severe they create systemic risk. In one example context, it could mean risk to the economic system as a whole. This is one of the reasons why some governments stepped in to bail out or guarantee failing banks during the global financial crisis in 2007 and 2008. Could a few Internet companies become so central to how we do business, deliver public services, and sustain social and political life that the failure of one could create cascading effects throughout the economy as a whole?

Cascading effects would likely only occur if the platforms' services were not substitutable. This would mean that when the service failed, those depending on it were not able to find and implement a replacement. While the likelihood of such a crisis is speculative, its potential consequences are vast and unpredictable. Will our growing dependence on the largest Internet companies motivate a wider concern to ensure they survive, no matter what? This could unintentionally hamper the continuing technological and business innovation the Internet supports, effectively creating permanent favourites.

API-driven dependencies

A platform's SDKs and APIs, which provide access to functionality of a service or platform, are increasingly important building blocks for technology and business innovation. APIs are often used by an application that, in turn, is used by another application, and so on. If an API fails, changes its conditions, or shuts down, it will likely harm all dependent businesses built on top of it. The resultant harm could range from negligible (such as when a service is easily substituted) to severe or critical (such as when a service is otherwise completely unavailable or when the loss of the service does not completely break another service).

For example, the ride-hailing service, Uber, has been using Google Maps' API to connect drivers and customers to routes and directions.[46] This integration was a critical part of Uber's success, but it meant the company's core activity depended on access to another firm's API. The conditions for that access could change[47] at any moment and abruptly alter or even hamper a company's ability to operate. Uber's investments and acquisitions of mapping technology is seen by some as a way to reduce the company's dependency on the Google Maps and other APIs for its services.[48]

The same type of dependency can be seen in applications developed in the cloud Platform as a Service (PaaS) market. PaaS offers an easily accessible software environment for operating systems and middleware that can include critical business functions like database management or specific AI/ML capabilities. If providers change the conditions, greatly increase the prices, impose unacceptable conditions, decide to abruptly terminate services, or simply fail to continue providing the functionality their client-businesses depend on, these businesses may fail and create a further cascade of failure elsewhere in the economy.

Service failures happen all the time. The core concern is not that of vertical integrated providers, which is expected in layered technologies, but

substitutability, which becomes an issue when a service is proprietary such that alternatives cannot be had at any price. If a single provider has several such popular services that cannot be substituted, then it becomes critical to a broader range of economic activities, and may be too big to fail.[49]

Governments may use single providers

Government departments and agencies may contract with large companies who can act as single providers of important systems. This allows governments to adopt the most up-to-date functionalities that citizens expect. The scale required often means only the biggest providers are suitable. For instance, cloud-based services from single providers like Google's G Suite[50] or Microsoft 365[51] are targeted to governments looking for broad and flexible solutions.

The U.S. Department of Defense has been criticised for considering use of a single provider, likely Amazon Web Services (AWS), to move its data to the cloud.[52] This could create critical dependencies. While technical responses may mitigate the associated risks involved, and private sector provision of services to government is hardly new, it raises important questions about how much public institutions should become dependent on a small set of powerful actors in the Internet economy.

Could our increasing reliance on just a few companies in the Internet economy create critical dependencies, or make them too big to fail?

An important feature of the Internet's success has been its ability to evolve, where no specific company or technology is above disruption, evolution, and competition. As the largest companies establish dominance in more markets and sectors of the economy, our dependence on them is growing, raising questions about what extent this feature still holds true. The reality is that some of the largest Internet companies are already more valuable than most governments on earth.[53] They are seemingly

becoming the central locus of new innovations, services, and businesses across the global economy.

As we consider the future, several questions arise: Could our increasing reliance on just a few companies in the Internet economy make them too big to fail? Are there economic and technical dependencies on services that cannot be substituted that effectively create a set of permanent favourites?

> "
>
> The information superhighway cracks apart more easily when so much of it depends on privately owned infrastructure. An error at Amazon Web Services created losses of service across the web in 2017; a storm disrupting a data center in Northern Virginia created similar failures in 2012.
>
> —The New York Times, October 2018
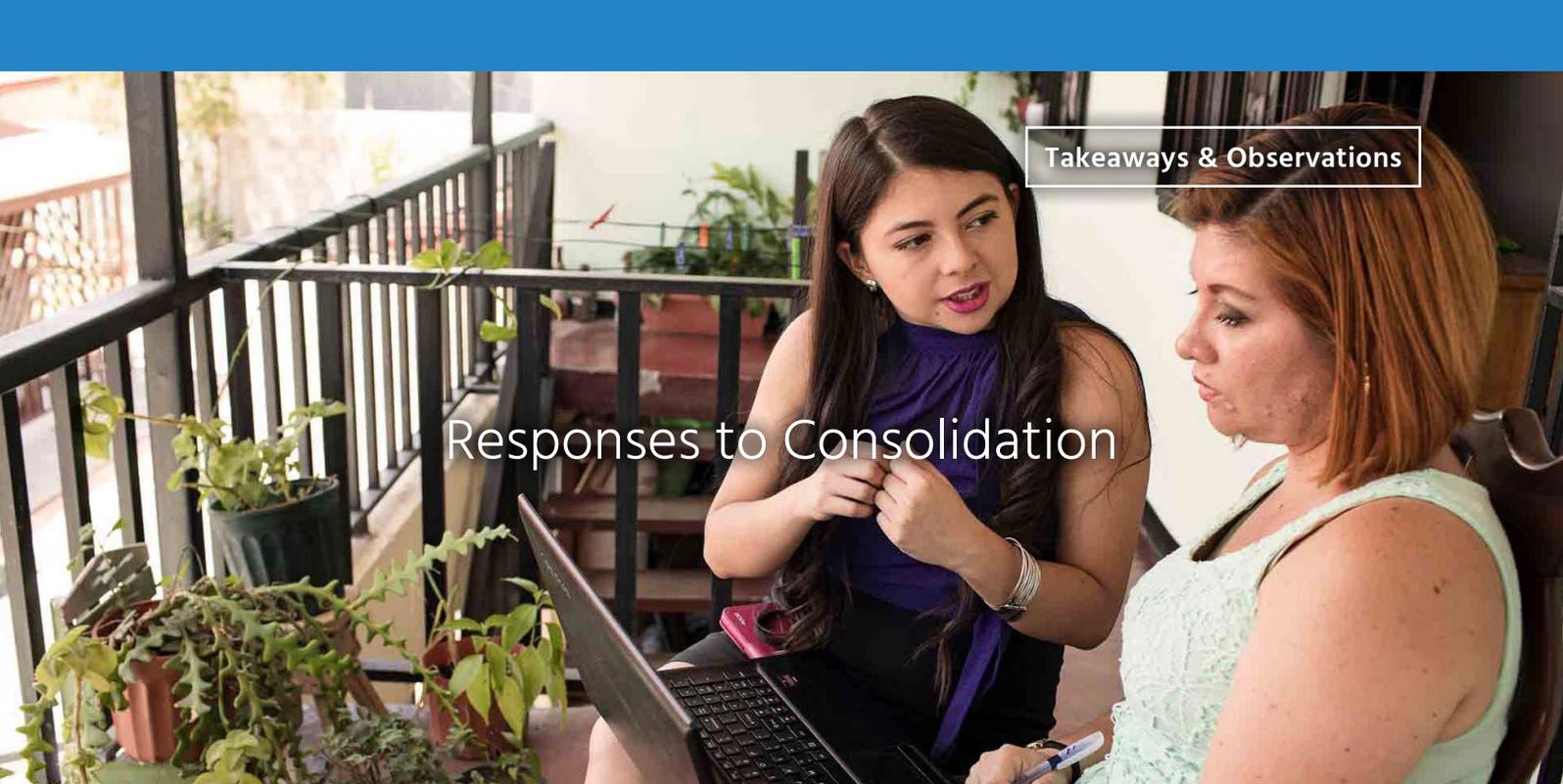
Responses to Consolidation

Summary

- Responses to the negative effects of consolidation have been distributed across the applications, services, and access domains of the Internet economy; in different sectors, regions, and by different institutions.

- Countries have adopted different strategies. Some have a higher tolerance for the risk of dominance if it also delivers Internet access and services, and they may have a traditionally lower tendency to regulate. Others, such as those in the European Union, are mobilizing more concerted, cross-agency responses (often spanning competition, consumer protection, and data protection regulators).

- Similarly, different stakeholder groups have also focused on different issues as far as dominance is concerned.

Examples of government responses

As awareness grows of the potential economic, developmental, and social benefits of the Internet, as well as its challenges, governments around the world have taken increasingly interventionist, but also diverse, stances to dominant actors in the Internet economy. Some politicians publicly denounce the power of large companies or threaten to regulate, like U.S. President Donald Trump, who has accused Google's search engine of ideological bias,[54] or French President Emanuel Macron, who has warned that Americans may come to see "Big Tech" as "not just too big to fail, but too big to be governed".[55]

Besides making controversial public statements, governments are increasingly asserting their authority to compel global tech companies to adhere to local laws. Examples of government initiatives in this field, with a variety of justifications, include:

- Data localisation laws (seen in Russia, Indonesia, Vietnam[56])

- Data protection frameworks (e.g., General Data Protection Regulation, or GDPR, in the European Economic Area; the African Union's Convention on Cyber Security and Personal Data Protection; and France, Germany, and the UK's enforcement actions and investigations into data protection[57])

- "Digital protectionism"[58] and taking steps towards and state-encouraged consolidation (e.g., China[59])

- Challenging alleged tax avoidance (e.g., the European Commission, Apple, and Ireland[60])

- Investigating and/or imposing taxes and content restrictions to protect the revenues of incumbent operators (e.g., Zambia,[61] Uganda,[62] and Tanzania[63])

> 55.5% of our survey respondents said consolidation is likely to trigger a response in government policy and regulation over the next five years.

Other countries, like the UK, have taken a broader approach by constituting a panel of experts to investigate and consider potential responses to digital dominance.[64] The overall trend where governmental responses are concerned, however, is of much more interventionist state action to compel platforms to fulfill a variety of public objectives on competition, taxation, data protection, consumer protection, and content regulation and plurality. This trend is driven partly by consolidation, but also by the sheer size and rapidly growing influence of platforms in many countries around the world:

- The EU has opened competition cases and taken enforcement action against U.S. tech giants for abuse of market dominance. It has, for example, levied large fines against Google's comparison-shopping services,[65] and its Android[66] mobile operating system, for abuse of market dominance. Antitrust authorities in the U.S., Argentina, Canada, Brazil, Israel, Taiwan, India, South Korea, and Russia have similarly opened antitrust cases against Google.[67] While most competition authorities primarily use traditional models focused on consumer harm arising from dominance, some legal scholars and practitioners argue for the need to consider broader economic issues and future market consolidation.[68] At the same time, the interplay between competition law, consumer protection law, and data protection has become increasingly important and complex, leading to calls for relevant regulatory agencies to better collaborate to achieve more holistic responses to digital dominance (despite potential turf wars).[69]

- Many states have also expressed concern over the uneven tax obligations faced by local tech start-ups and traditional firms versus global

Responses to Consolidation

tech platforms, which are able to minimise their local tax liabilities partly due to their international structures. In March 2018, the European Commission announced proposals to allow EU countries to tax profits generated within their territory, regardless of the physical presence in the EU of the company generating the profits. It also proposed a 3% interim tax on digital activities currently not effectively taxed to generate immediate revenues for EU member states.[70]

- A growing number of countries are trying to deal with concerns of political radicalisation and threats to electoral political processes, driven by the platforms' increasing role as a locus of societal debates and their information dissemination models.[71] Germany now gives social media platforms 24 hours to remove content that violates existing provisions in Germany's criminal code.[72] The European Commission has called upon platforms to tackle online disinformation, as "the weaponisation of online fake news and disinformation poses a serious security threat to our societies."[73] In Bangladesh, new digital security legislation imposes jail sentences for offences like spreading misinformation or distributing "negative propaganda" using a digital device.[74] Brazil has drafted bills against fake news currently that are under examination by Parliament.[75] One such bill proposes fines and up to 4 years of imprisonment for users who disseminate "fake news."[76] Malaysia has outlawed so-called "fake news" entirely, the first measure of its kind in the world.[77] Indonesia has established a government agency to "monitor news circulating online" and "tackle fake news."[78] There are clear risks that these measures be used punitively against opposition parties, activists, journalists, and others, and many of these laws may have extra-territorial effect. They could also prove virtually impossible to implement.

- As people grapple with the vast extent of data collection central to the business models of platforms, some regulators and governments have adopted or expanded privacy measures

and data protection provisions. Concerns relate not only to the use of personal information to influence individual choices, but also to the possibility of data leaks. The European General Data Protection Regulation (GDPR) recently came into effect, with sweeping changes to consent and many other issues. Data protection authorities in the Netherlands,[79] France,[80] Germany,[81] and Belgium[82] have already launched investigations about or taken steps to enforce user-consent for advertising purposes.

It is problematic that these and other measures often focus on issues in isolation, potentially failing to understand how different activities fit into the platforms' overall business models. Some could create unintended consequences by imposing rules with which only the largest companies can comply, further strengthening a dominant position, or by undermining the open and global nature of the Internet itself.

Traditional regulatory tools are evolving to account for the specifics of the Internet economy.[83] Regulators are on a steep learning curve, and seem to rarely coordinate with other government actors or regulators with different expertise or mandates looking at the same companies. So far, no holistic responses to consolidation have emerged.

In publishing this report, one of our hopes is that policymakers and other decision-makers begin to understand that consolidation in the Internet economy is a much more complex set of issues than the popular press typically covers. Furthermore, this report demonstrates that consolidation trends have positive and negative implications at a number of different layers of the Internet, and that these implications are often interrelated.

Examples of responses from other stakeholders

Some actors in the Internet technical community have also responded to consolidation trends with targeted approaches:

Responses to Consolidation

- The Internet Architecture Board (IAB) has kicked-off a community discussion with a post on the IETF's blog[84] and the publication of a working document (or "Internet-Draft") providing some perspectives on the issue.[85] Further IAB activity on the topic is reportedly planned for 2019.[86] The software company Mozilla has made proposals to the U.S. Federal Trade Commission around API governance, which it calls "'the fundamental connective tissue of the Internet."[87]

- Tim Berners Lee's Solid project, located at MIT, "aims to radically change the way Web applications work today, resulting in true data ownership as well as improved privacy,"[88] with a platform for decentralised but linked data applications under the full control of users. Other developments related to blockchain technologies have similarly led to broader enthusiasm for a broader decentralisation movement, which may yield specific and useful applications, even if a "revolution" still seems somewhat remote.[89]

- Google engineers have taken steps to protest their employer's proposal for a country-specific search engine to meet China's censorship requirements;[90] Facebook engineers have complained about a lack of political diversity on the platform;[91] and the www.neveragain.tech platform encourage programmers to pledge not to allow data gathering and analysis to be used to collectively harm ethnic groups in the U.S.

Finally, civil society organisations, NGOs, and intergovernmental organisations[92] have been vocal about the need for transparency and oversight of influential Internet companies. They play an important role in highlighting gaps. These gaps are, most notably, in the protection of human rights in a diversity of areas ranging from concerns about the gig or platform economy and labour rights,[93] and Internet users' freedom of expression and privacy on social media platforms that are increasingly important public spheres for the exchange of ideas and debates.[94] These and other civil society organisations have started to develop practical standards, benchmarks, and incentives for global platforms to respect human rights everywhere they operate. This includes discernible self-organisation by consumers, (e.g., capacity-building by organisations like Consumers International), to influence business and governments on digital issues.[95]

> 37% of our survey respondents said that there are current efforts in their country or region to address concerns about market dominance in the Internet economy.

Will governance efforts remain siloed?

Many of the consolidation trends highlighted in this report result from platforms leveraging market incentives and opportunities, as well as Internet users' enthusiasm for the quality, range of offerings, and lower prices – or seemingly-free services – that platform environments can provide. While there is nothing inherently wrong with these trends, concerns remain, including competition, choice, data and consumer protection or welfare, dependencies, and the potential for single points of failure, as well as societal challenges exacerbated by size, scope, and speed of social change wrought by platforms. How those concerns are addressed in the coming years will not only determine the success of addressing the specific question at hand, but also the future development of the Internet as a whole.

This challenge is also an opportunity to test the efficiency of collaborative multistakeholder approaches that typify Internet governance, ensuring a diversity of views inform policy and technical decisions. But will this methodology be effective and sufficient? The question remains to be answered and will largely depend on the ability of stakeholders to quickly stop working in silos.
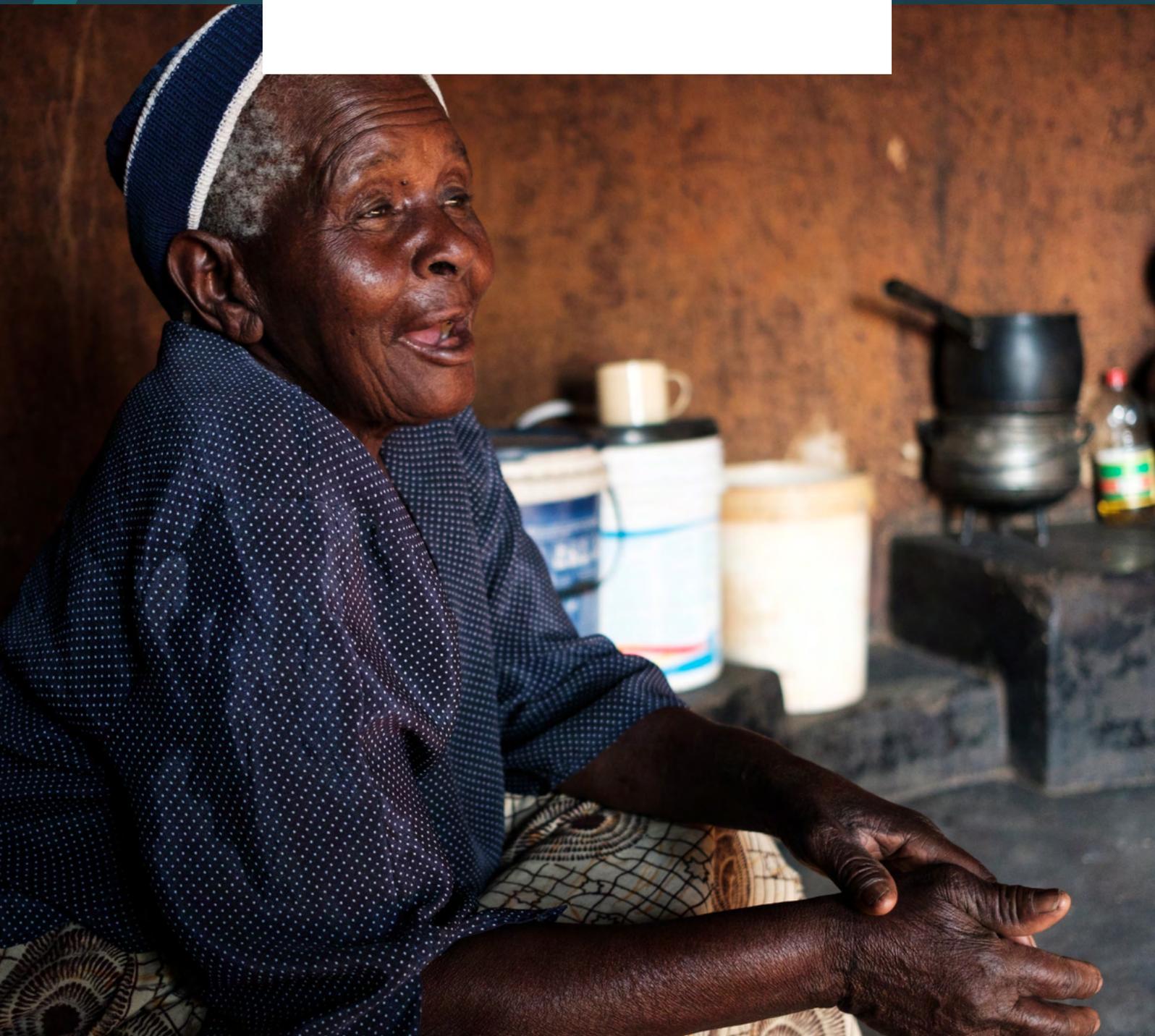
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7

Impact Analysis

How Could Consolidation Impact the Internet in the Future?

As this report has explored, trends of consolidation are visible in all parts of the Internet economy. For most users, these trends are most obviously visible in the applications domain, in which a small set of providers are dominating the provision of services such as search, social networking, and e-commerce. But even if they are perhaps less obvious to most users, trends of consolidation are also occurring in and across the other two domains: Access Provision and Service Infrastructure.

If these trends continue unabated in the coming years, what does this mean for the Internet's technical evolution and use? In this section, we will consider the impact of consolidation through the lenses that guide how we see the Internet.

The projected impact of consolidation trends on users' abilities

We believe that the Internet and its invariants empower users with certain abilities. These abilities underpin the social value that the Internet provides to people, and includes the ability to connect, speak, innovate, share, choose, and trust. Some of these are bound to be more susceptible to impact from consolidation trends if they continue unabated.

The ability to choose

Consolidation trends that continue on their current trajectory will probably most profoundly impact users' ability to choose between services. The limitation of choice will likely also indirectly affect a broader set of abilities, with different implications depending on the economic domain, specific parameters of the geographical region concerned, and the degree of competition.

If current consolidation trends continue, a scenario could arise in which 1, or possibly 2 proprietary platforms dominate parts of the Internet economy. All other innovations and services would evolve around these platforms. The network effects, which help enable platform dominance, could lead to a small number of dominant actors in almost any service area. Combined with ownership of a strategic infrastructure and vast amounts of data for improving the quality of service, it could become increasingly difficult for new actors to challenge the large incumbents in any of the core platform services they currently provide. Similarly, given that the same resources could be used for deploying new platforms or services, today's dominant players are at a great advantage to capture new markets that may emerge.

The current trends of consolidation at the application layer, in particular, tend to follow traditional patterns of consolidation in other parts

of the economy. This includes, for instance, the acquisition of smaller competitors to grow market shares, and attempts to capture a greater part of the value chain by nudging customers towards a "store-brand" have a lot of precedents in other parts of the economy. But our question for the future is: to what extent will such strategies be available for today's dominant players, given that regulators are increasingly scrutinizing how the platforms leverage and exploit their dominance in one area to favour services in another?

Underpinning this question is a need for further analysis and a more nuanced understanding of the nature or abuse of dominance in a certain market, and how to define relevant markets for competition law purposes. Such definitions, which relate to the evolution of competition or antitrust law, must consider factors like the multisided nature of platforms, the proprietary conditions for interoperability, and the cost of personal data as a consumer price.

The ability to innovate

Large Internet companies are increasingly the go-to platforms for innovation and have become useful in lowering the threshold for new innovators to engage in the Internet economy. For example, social login functions offered by some social media platforms enable new developers to outsource the need for developing complex systems for managing not only membership and login credentials, but also the security and legal requirements related to these. Similarly, large cloud service providers like AWS, Microsoft, and Google are increasingly offering a full suite of services, from DNS hosting to CDNs. This move enables new business to scale and take advantage of a service infrastructure that might have previously been reserved to a small set of businesses.

These evolutions can significantly strengthen users' ability to innovate by developing and deploying new services and applications. But the trends towards an

increased dependency on well-known proprietary platforms for interoperation also imply a shift towards a qualitatively different environment than one defined by permissionless innovation, even where open standards support the interoperation. We must ask: To what extent will new innovations concentrate around a few large players, and will they depend on some central functionalities?

While the World Wide Web emulates the properties of the Internet itself and provides an open platform for innovation on which anyone can offer an unrestricted service, many web-based applications do not. These platforms are often essentially monopolistic and tend to be proprietary, closed, and can restrict or constrain the provision and availability of new services and applications. They also reinforce an opportunity divide between developed and developing countries. Mobile app stores[1] do this by imposing geographical restrictions.

The ability to connect and trust

While scale in the provision of a particular service can be beneficial from the view of affordability, availability, and security, it also creates dependencies that have wide-ranging consequences. The Internet's fundamental property of having no permanent favourites is premised on the notion that the Internet does not discriminate between technologies, companies, and regions, but that their continued success depends on their continued relevance and utility. Simply put, the Internet is where [g]ood ideas are overtaken by better ideas.[2]

But the concentration of developments around one or a small number of platforms could expose users and companies to vulnerabilities in the shared software and infrastructure. The degree of concentration in one or more platforms or services, and the substitutability between them, is a strong determinant of the security and trust implications that will arise from unchecked consolidation.

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How Could Consolidation Impact
the Internet in the Future?

Related to these overall concerns about future dependency on a limited number of providers is the question of whether some of the large Internet companies could be too big to fail. This is understood as the potential consequences of one company's failure being so severe that they are said to create systemic risk. If current consolidation trends continue unabated, the Internet economy, and by extension the broader economy, may have critical dependencies tied to the services of a few large players. Further analysis into such risks would need to account for the substitutability of a particular service or functionality, and how they relate to the broader economy.

On the other hand, trends of concentration in the provision of many services described in this report are often accompanied by many benefits. DNS hosting or CDNs are services that will continue to benefit from economies of scale, and as long as competition persists among the large providers, it will make services like advanced DDoS mitigation more affordable and readily available to a broader range of users and content providers. In the absence of a complete market dominance, or practices leading to single points of failure (e.g., failing to use multiple DNS hosting providers), these trends could have positive effects on security and the Internet's resilience.

The ability to share (and collaborate)

The Internet is less about specific technologies and more about collaboration. From open standards and mutual agreements between networks to exchange data, to policy development and governance, sharing and collaboration are at the core of what differentiates the Internet from other networks. It is not a nice-to-have, nor is it a given, but a property of the Internet itself. This is why consolidation issues are so closely tied to ability of a few people to make decisions that impact everyone. Whether a decision is about technical protocols for interoperation, or policies striving to empower and protect users, it will require collaboration to ensure an "open, globally-connected, secure, and trustworthy Internet for everyone" in the future.

8

Conclusions and Questions for the Future
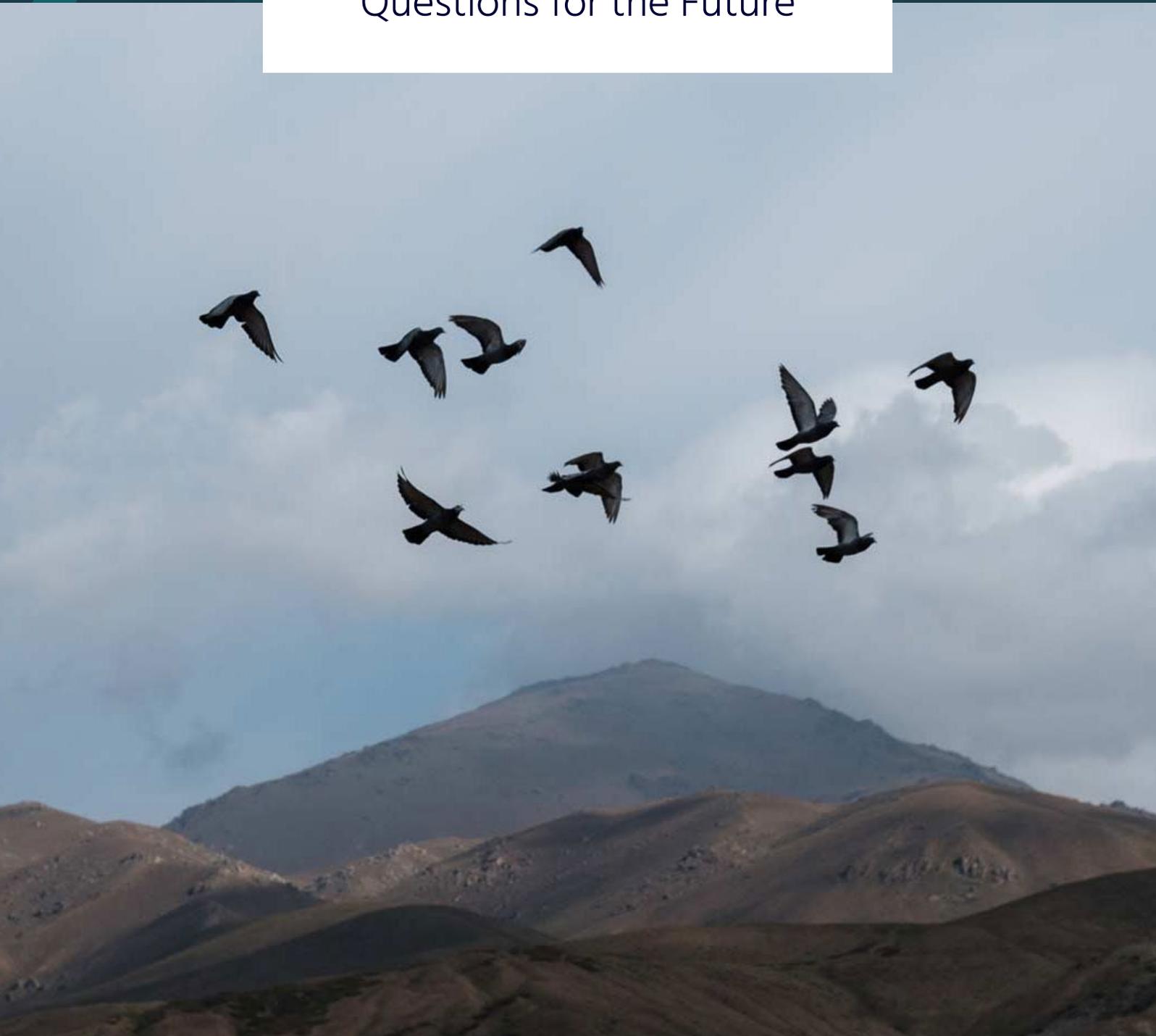
In this report, we have investigated trends of consolidation in and across different layers of the Internet economy, and how they may impact the evolution and use of the Internet in the future. We conducted this analysis through the lens of how we at the Internet Society see the Internet. We specifically investigated the impact of consolidation on the Internet's fundamental properties[1] (or invariants), including interoperability, collaboration, flexibility, accessible, permissionless innovation, and the notion of global reach. Because we believe people are at the centre of the Internet, we also explored the impact of these trends on people's abilities to connect, to share, and to innovate.

While this investigation enabled us to better understand some key features of consolidation, as well as the impact of emerging trends on the development of the Internet and its use, it generated more questions than answers. To paraphrase Socrates, we know now that we know (almost) nothing. Unlike most of our previous reports, therefore, we conclude without a clear set of findings or policy recommendations, but rather with an even longer set of questions that we think demand clear answers and rigorous data before we can formulate clear evidence-based recommendations for responses. We feel strongly that hasty governance interventions to consolidation trends, especially from a policy perspective, could lead to unintended consequences and harms for the Internet and its users.

Most popular press coverage of consolidation fails to dive deep enough to fully grasp the issue. Our hope is that this report will help policymakers and other decision-makers understand that digital consolidation involves a complex set of issues, and that policy responses to consolidation will impact different layers of the Internet. Responding to consolidation trends in one field without considering how these trends echo and reverberate in other fields or layers could lead to unintended

and damaging consequences for the Internet and economic development.

In order to build the evidence base we believe is crucial to develop a more thorough, comprehensive understanding of digital dominance and its consequences, we have identified some questions to provoke thought. **These questions also suggest ways to mitigate the negative effects and foster the positive impact of consolidation:**

- What are the relevant indicators for assessing the impact of consolidation over time? What metrics are available, and how can the Internet community collaborate to monitor trends over time?

- How are current trends of consolidation impacting different regions, and are they exacerbating or mitigating digital divides? Is consolidation responsible for creating new digital divides, meaning that some services are offered to others and some are not?

- Could our increasing reliance on just a few companies in the Internet economy make them "too big to fail"? Are there economic and technical dependencies on services that cannot be substituted that effectively create a set of permanent favourites?

- To what degree is concentration, and in some instances near monopolies, on the Internet a result of particular characteristics of the service involved? Are there natural monopolies for some Internet [enabled] services, for which the most efficient number of firms is one? And if so, why?

- Does the current trend of new traffic patterns, what has been referred to as a "flattening Internet topology", constitute a concern or an opportunity for the long-term viability of the open Internet? Are there indications that current trends, of private networks deployed by dominant actors in content and cloud provision,

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1   Internet Society (n.d.). How we see the Internet. Available at: https://
    future.internetsociety.org/introduction/how-we-see-the-internet/.

may be crowding out access to a general-purpose Internet? Are users facing an access environment that is increasingly optimised for the delivery of services owned by a few, or for access to an open and globally-connected Internet?

- Do new protocols, standards, or practices championed by especially large organisations have positive effects for all or only some? How does concentration in particular services effect the development of standard and non-standard protocols on the Internet? How do the technical community and other stakeholders ensure that there continues to be thriving development and pipeline of open standards that contribute to ensuring continued interoperability and data portability as the Internet economy evolves?

- If regulation were needed to address consolidation, would it be better to go via the route of consumer protection, competition, or administrative law?

- How do we ensure that any regulatory responses do not interfere with the Internet's underlying properties, i.e. that they do not "break" the Internet?

> "
> To preserve competition and better technological standards in an economy that is consolidating, there is a need to build up an understanding of the technical and philosophical principles of the Internet in regulatory institutions, governmental standard-setting bodies, and the general public.
>
> — Regional panel report, The Centre for Internet and Society, India

The Internet Society looks forward to exploring these questions in 2019 with industry, civil society, and policy leaders. It has a large and growing community of members across the globe. We look forward to harnessing the power and knowledge of this community to identify together the best approaches for the future.

9

Methodology
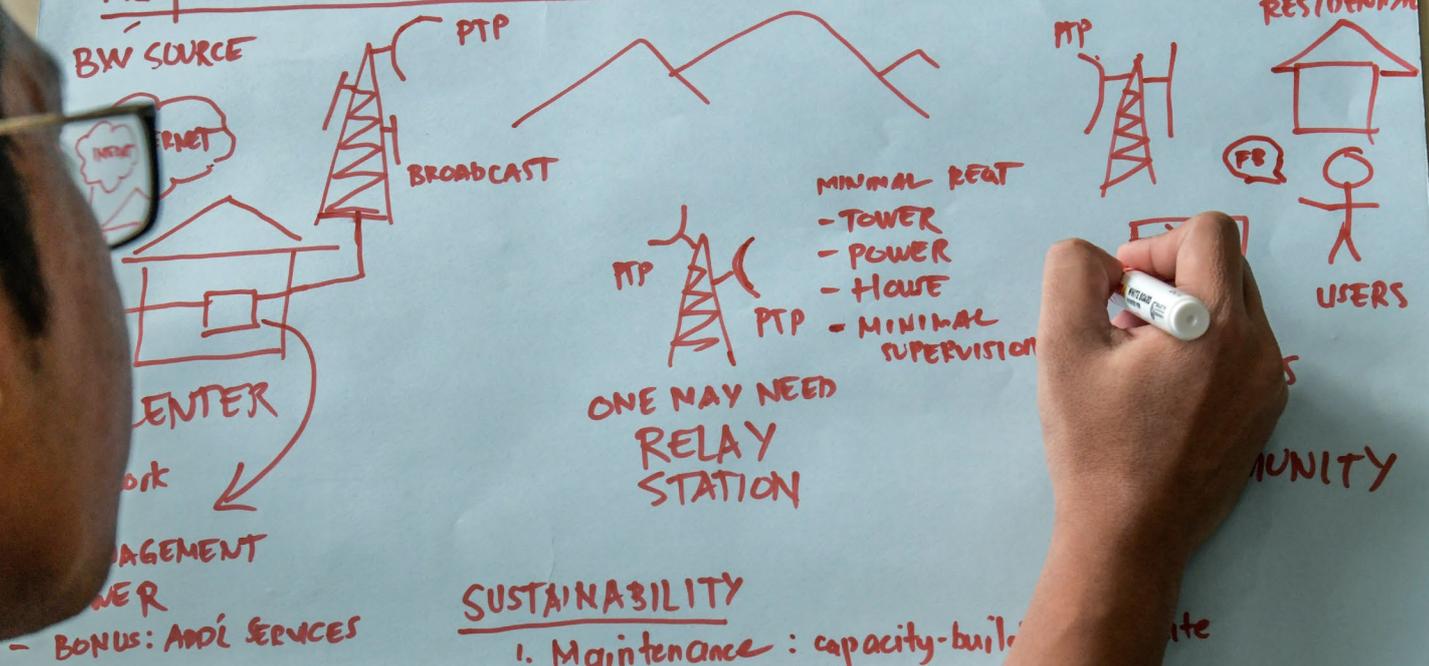
The topic of consolidation and concentration in the Internet economy, along with these trends' impact on innovation and evolving competition, consumer and data protection laws in general, and the Internet's architecture in particular, is a complex one to research, analyse and understand. Indeed, in 2017 and 2018 an increased number of popular and academic works in different sectors and disciplines have prodded the topic from a variety of angles (many of which are cited in this work where relevant). But none of these have focused on the impact of these trends on the Internet's multifaceted architecture – and this is an important finding in itself for the report. By failing to investigate trends in and across the application, services, and access layers, existing work on these trends is lacking a comprehensive understanding of the very characteristics which not only enable people to benefit from using the Internet on a daily basis, but which have also helped certain companies leverage their size to gain digital dominance.

In attempting to fill this gap and to contribute a more holistic understanding of both the existence and the impact of consolidation and concentration trends for the Internet and its architecture, the Global Internet Report project team adopted a multidisciplinary, mixed method approach to gather both primary and secondary data on these trends. A primary objective of the research design was to elicit and gather opinions and perspectives from the global Internet community (Internet Society members and staff, Internet policymakers, technologists, academics, business leaders, and others around the globe) about the key forces of consolidation and concentration and their impact on the future evolution of the Internet. The analysis and consolidation of these opinions and perspectives form the core of the findings in the report.

The work was conducted in two phases. The first phase was concerned with data gathering, and the second with analysis. The two phases were iterative: as the need for more data on particular issues arose in the second phase, more research was therefore conducted.

Each of these activities, and the data points which were created by them, are briefly described below.

Phase I: Data gathering

The project team gathered community and expert input through a number of elements:

- An extensive literature review conducted by an external group of Internet researchers;

- A community survey which attracted a significant number of responses

- Regional round tables organised in partnership with independent local research institutions

- Focus groups at various global and regional community events

- Special chapter sessions with Internet Society chapters

- Select practitioner and expert interviews

These are discussed separately below.

Literature review

To better understand and frame the perceived trends of consolidation and concentration in the Internet economy, the team commissioned independent researchers at DiploFoundation to review available popular and scholarly literature. The initial purpose of this desktop review was to provide evidence of trends (if available) to support

and investigate the hypothesis that trends of consolidation and concentration are impacting the development of the Internet and the Internet Economy in particular, yet poorly understood, ways.

DiploFoundation particularly investigated certain priorities the project team had identified at an early stage, including:

- What available definition(s) of centralisation and concentration are in the context of the Internet and the Internet economy

- How potential trends of concentration and consolidation may be affecting the Internet and its users in developing regions, and traditionally marginalised people in developed and developing regions alike

- How these trends are impacting the drivers identified in the 2017 *Global Internet Report* report

- How these trends were being depicted in both popular media and academic journals, what themes were being focused on by other scholars and practitioners in the field, and where the research gaps might be

- Whether there are specific cases that could be used in the project team's work to illustrate trends, if relevant

- Whether there are any existing indicators that could be used to measure the nature and extent of these trends

The researchers produced a comprehensive and useful background document with relevant sources and data points which fed into the final report.

Community survey

The literature review and other data discussed in this section were complemented by a global survey conducted over the course of a month in early 2018, with the intent to gather qualitative and quantitative data from stakeholders, experts and Internet users around the world. The survey was designed by the project team based on key trends identified in the literature review, and contained open-ended and closed questions. It measured respondents' perception of the health of Internet abilities, the trends of consolidation and concentration, and how they are impacting theevolution of the Internet. The survey questions are available here.

In total, 1,550 survey responses were received, and approximately 73% of respondents self identified as Internet Society members. 27% of the respondents were from Latin America, with roughly the same number from Africa and Asia Pacific respectively (21%). 12% of the respondents were from North America and 16% from Europe.

The findings from the survey fed into Phase II's analysis.

Regional round tables

The importance of gathering varied views from different regions was recognised as central to the project. Experience from previous years' work reflected the need for improving developing country participation in any dialogue or process pertaining to the development of the Internet. It recognised the difficulty many stakeholders from developed regions, particularly in the Global South, face in participating in debates and processes relevant to the Internet's governance.

To improve and bolster regional input, the project team identified a group of regional research centres or think tanks with strong research capabilities and a history of policy impact in their regions. The selected **four regional partners** were:

- The Centre for Internet and Society, India

- Research ICT Africa's Digital Policy Project (affiliated to the Nelson Mandela School of Public Policy, University of Cape Town), South Africa

- Diálogo Regional sobre la Sociedad de la Información (DIRSi), Peru

- Fundação Getulio Vargas (FGV), Brazil

The regional centres each hosted at least one round table or a similar exercise to gather primary and secondary data on the theme and its impact in each centre's region in particular. They designed their activity for input themselves, and also used their own regional expertise to identify and invite relevant participants. The selection of participants was guided by the desire to reflect the views and interests of a diversity of stakeholder group and aimed for balance regarding interests, stakeholder type, gender balance, geography, and expertise.

Each centre prepared a detailed report summarising the main points made during the discussion.

Focus groups and special chapter sessions

As in previous years, the project team hosted a number of focus groups at various global and regional community events to gather more input about the theme, and also specifically invited Chapter members for calls on the theme. The events where the team held focus groups and round tables included:

Events	Place (date of session)
Rights Con	Toronto, Canada (17 May 2018)
African Internet Summit (two sessions)	Dakar, Senegal (10 May 2018)
WSIS Forum (two sessions)	Geneva, Switzerland (22 March 2018)

The team also consulted with nearly all of its Chapters and Organisation Members at least once, and to that effect held a number of virtual focus groups with these stakeholders, including:

Chapter/region	Date, facilitated by
Africa Chapter (English)	24 May 2018, facilitated by Carl Gahnberg
Africa Chapter (French)	24 May 2018, facilitated by Constance Bommelaer
Asia Pacific & Middle East (joint session) (English)	25 May 2018, facilitated by Carl Gahnberg
Latin America & Caribbean (English)	30 May 2018, facilitated by Constance Bommelaer
Latin America & Caribbean (Spanish)	30 May 2018, facilitated by Nancy Quiros
North America (English)	5 June 2018, facilitated by Mark Buell
Caribbean Chapter (English)	13 June 2018, facilitated by Carl Gahnberg
Internet Hall of Fame (two calls, English)	19 June 2018, facilitated by Carl Gahnberg 20 June 2018, facilitated by Carl Gahnberg
Organisation Member Advisory Council (two calls, English)	28 June 2018, facilitated by Constance Bommelaer 11 July 2018, facilitated by Carl Gahnberg

Data and insights gathered in these sessions were compiled and used in Phase II.

Practitioner and expert interviews

In addition to a number of informal conversations with stakeholders, approximately ten interviews were conducted with experts from governments, civil society, businesses, academia and the technical community. The interviews solicited views on how the Internet has changed over the past five years, on the trends of consolidation and concentration, and their consequences. To encourage the most robust set of views on the future of the Internet, the informal discussions used the term "Internet" in its broadest sense, encompassing everything from its structure, governance, and underlying technologies to access, usage, and connected devices.

Phase II: Compilation and analysis

In Phase II, the data collected in the first phase was compiled and analysed by the project team. The team identified common themes and developed a framework for its analysis by also consulting with other practitioners working in the Internet Society's technical teams. Where necessary, the team, in an iterative manner, conducted more research to get a better understanding of specific themes.

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Community Survey:
Questions and Results

Community Survey: Questions and Results

In early 2018, the Internet Society conducted a global survey to gather qualitative and quantitative data from stakeholders, experts, and Internet users around the world. The survey was designed by the Global Internet Report project team based on key trends identified in the literature review .

In total, 1550 survey responses were submitted, and approximately 73% of respondents self-identified as Internet Society members. 27% of the respondents were from Latin America, with roughly the same number from Africa and Asia Pacific respectively (21%). 12% of the respondents were from North America and 16% from Europe.

These findings from the survey fed into the project team's Phase II analysis.

Survey Questions

Part 1

- **1.1 The ability to connect:** All Internet users, wherever where they live, should be able to connect to any other point to keep the Internet as a platform for innovation, creativity and economic opportunity.

    ◦ Q: Do you feel that you can connect to anyone and anywhere on the Internet?

- **1.2 The ability to speak:** For the Internet to work as a medium for self-expression, users need to feel they can speak freely and collaborate without restriction. Private, secure and – when appropriate – anonymous communications let us express ourselves safely and securely.

    ◦ Q: Do you feel that you can express yourself online in a safe and secure manner?

- **1.3 The ability to innovate:** The Internet was built on open connectivity and standards development. To keep it developing, so everyone can use it to innovate, we all need to be able to develop and distribute new applications and services on it.

    ◦ Q: Do you feel you can develop new applications and services, without governmental or private sector restrictions?

- **1.4 The ability to share:** The Internet enables sharing, learning and collaboration based on fair use, and the freedom to develop and use open source software.

    ◦ Q: Do you feel that you can fully share and collaborate online?

- **1.5 The ability to choose:** User choice in competitive communications markets brings better, cheaper, and more varied and innovative services. Being able to choose communication and service providers lets users control their Internet experience.

    ◦ Q: Do you feel that you can choose between Internet services?

- **1.6 The ability to trust:** Our abilities to connect, speak, innovate, share and choose all depend on trust. For us to trust Internet networks, applications and services, we need them to be secure, reliable and stable.

    ◦ Q: Do you feel that you can trust applications and services online?

Part 2

- Is there a trend of consolidation in the Internet Economy, as described above?

- If you agree there is a trend of Internet consolidation, do you think it is more visible in certain countries or regions, or is it a global trend?

- Looking just at your region, do users find their app and service choices to be limited?

- Have you noticed the larger players in the Internet economy increasingly influencing standardization for networking, technology, software and interoperability?

- Have you observed any concentration of network traffic or Internet architecture?

- Are there any efforts in your country/region to address concerns about market dominance in the Internet economy?

- Do you think consolidation is a problem, and, if so, what should be done about it?

- Over the next five years, do you expect consolidation to significantly shape the evolution of the Internet's technology and networks? (For example, by limiting the choices you have for

which operators to use for gaining broadband access)

- Over the next five years, is consolidation likely to significantly impact the scale and severity of cyber attacks and crime? (For example, by facilitating the development of malware to quickly spread viruses on commonly used platforms or browsers)

- In the next five years, is consolidation likely to impact online freedoms and rights? (For example, by enabling surveillance or censorship, or alternatively by making it easier for people to communicate and connect?)

- In the next five years, is consolidation likely to significantly impact national, regional or global digital divides? (For example, by bringing more or fewer people online, or by affecting the ways they can use the Internet?)

- Over the next five years, is consolidation likely to trigger a response in government policy and regulation? (For example, through regulation that aims to limit larger Internet companies from acquiring startups if the result is reduced competition)

Survey Results

Visit https://future.internetsociety.org/2019/community-survey-questions-and-results/ to see the survey results.

About the Internet Society

The Internet Society works for an open, globally-connected, secure, and trustworthy Internet for everyone.

We are the world's trusted independent source of leadership for Internet policy, technology standards, and future development. More than simply advancing technology, we work to ensure the Internet continues to grow and evolve as a platform for innovation, economic development, and social progress for people around the world.

With offices around the world, we work to ensure that the Internet and the web that is built on it:

- **Continues to develop as an open platform that empowers people** to share ideas and connect in new and innovative ways

- **Serves the economic, social, and educational needs** of individuals throughout the world — today and in the future

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