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Telecommunications Regulatory Affairs Advisory Committee

Cloud Computing and Cloud Services

Purpose

In October 2012, the 12th Global Symposium for Regulators of International Telecommunications Union ("ITU") issued the "Best Practice Guidelines on Regulatory Approaches to Foster Access to Digital Opportunities through Cloud Services" (the "ITU Best Practices"). In this paper, we benchmark the telecommunications regulatory measures adopted in Hong Kong against the ITU Best Practices and brief Members on our assessment. The paper also gives an overview of the initiatives undertaken by the Government, public agencies and the industry to facilitate the development of cloud computing and cloud services in Hong Kong.

Introduction

2. Adoption of cloud computing and cloud services has been growing rapidly worldwide. According to Asia Cloud Computing Association,[1] worldwide spending on cloud services is predicted to reach 30-40% of IT budgets by 2013 and US$150 billion by 2014.[2] A study conducted for the European Commission pointed out the potential benefits from the adoption of cloud services, which include cost savings, mobile working, productivity, standardisation as well as new business opportunities.[3]

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[1] Members of Asia Cloud Computing Association include Alcatel-Lucent, AT&T, CPC CITIC, Cisco Systems, CloudGarage, EMC Corporation, Genetic Finance, Huawei, Microsoft, NetApp, Nokia Siemens Networks, PLDT/Smart, Rackspace, Telstra Global, Telenor, and Verizon.

[2] http://www.asiacloud.org/index.php/news/press-release-cloud-readiness-index.

[3] The report is available at http://ec.europa.eu/information_society/activities/cloudcomputing/docs/quantitative_estimates.pdf.

3. Despite the potential benefits, cloud computing and cloud services have aroused concerns among governments, service providers and users. Cloud computing technology links up hardware scattered across multiple jurisdictions, and data are stored in and retrieved from different parts of the cloud. This raises questions as to whether the existing laws and regulations normally demarcated by jurisdiction boundaries are still applicable to the cloud environment, and if yes, how to enforce such laws and regulations. Owing to the cross-jurisdiction nature of cloud infrastructure, cross-border data transfer becomes inevitable and this raises doubt on the adequacy of protection from the existing data privacy legislation. Security is another major concern because of the massive amount of data stored in a shared infrastructure. Some overseas economies have already undertaken initiatives on review of data privacy legislation[4] as well as security issue[5] in response to the development of cloud computing and cloud services.

4. Sustainable development and competition in the cloud service market have to be underpinned by interoperability and portability. Interoperability is the ability of different cloud infrastructures to seamlessly communicate with each other. Portability is the capability of cloud service users to migrate their data and services from one provider to another without incompatibility issues. It is crucial to develop standards for ensuring interoperability and portability. According to ITU, there are at least 18 organizations that are developing standards related to cloud

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[4] For the review of data protection rules in the EU, please see http://ec.europa.eu/justice/newsroom/data-protection/news/120125_en.htm. The "Report on 2010 Office of the Privacy Commissioner of Canada - Consultations on Online Tracking, Profiling and Targeting, and Cloud Computing" is available at http://www.priv.gc.ca/resource/consultations/report_201105_e.pdf. For the proposed reform to the Australian Privacy Act, please see http://parlinfo.aph.gov.au/parlInfo/download/legislation/billsdgs/1923143/upload_binary/1923143.pdf.

[5] European Network and Information Security Agency published guidelines to assist companies to monitor security level of cloud services. The guidelines are available at http://www.enisa.europa.eu/activities/application-security/cloud-computing/procure-secure-a-guide-to-monitoring-of-security-service-levels-in-cloud-contracts. In Singapore, the Cloud Computing Standard Coordinating Task Force, led by IDA, has issued two technical references on "Virtualisation Security for Servers" and "Security and Service Level Guidelines for the Usage of Public Cloud Computing Services".

computing.[6] The European Commission has indicated in its new strategy on cloud computing that one of its key actions is to "cut through the jungle of standards" and identify the necessary standards by 2013.[7]

ITU Best Practices

(I) Aspects Relevant to Telecommunications Regulations

5. In the following paragraphs, we will highlight those aspects in the ITU Best Practices (see the **Annex**) that are relevant to telecommunications regulations and assess the readiness of our telecommunications regulatory regime to take on the new challenges brought about by cloud services.

Broadband Infrastructure

6. *Regulators are recommended to reduce barriers to broadband deployment, actively facilitate the rollout of fibre networks and international connectivity links, and promote infrastructure sharing and coordination of civil works.*

7. We have been making every endeavour to facilitate the rollout of broadband infrastructure across Hong Kong. For example, we play an active role in providing coordination to ensure that requirements of both fixed and mobile carriers on establishment of telecommunications facilities will be included in new development and infrastructural projects of the Government. Carriers are allowed to make use of Government

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[6] The standard developing organisations include International Organization for Standardization and International Electrotechnical Commission Joint Technical Committee, Institute of Electrical and Electronics Engineers, NIST, European Telecommunications Standards Institute, Cloud Security Alliance, Internet Engineering Task Force, Distributed Management Task Force, Global Inter-Cloud Technology Forum, Open Grid Forum, Storage Networking Industry Association, TM Forum, OASIS, Alliance for Telecommunications Industry Solutions, The Open Group, Cloud Computing Use Case Discussion Group, Open Data Center Alliance, The Green Grid, and ITU. For details, please see Part 6 of the FG Cloud Technical Report released by ITU-T's Focus Group on Cloud Computing at: http://www.itu.int/en/ITU-T/focusgroups/cloud/Documents/FG-coud-technical-report.zip.

[7] http://europa.eu/rapid/press-release_IP-12-1025_en.htm.

premises and public facilities, such as bridges and tunnels, to establish telecommunications facilities. With a view to assisting property developers to include adequate equipment rooms and ducting facilities for telecommunications and broadcasting services in the design of new buildings, we have issued a code of practice in September 1995 after consultation with our carriers and the building industry, which was last updated in April 2012.

8. Furthermore, with a view to arousing public awareness of the importance of fibre-based access facilities, we launched a voluntary registration scheme for residential buildings connected by fibre-to-the-home or fibre-to-the-building in November 2010. Around 13,500 residential buildings have been registered over the past two years.

9. To make it simpler and quicker for interested parties to land new submarine cables in Hong Kong, we offer a single-point-of-contact service to prospective applicants and liaise with relevant government departments and organisations with a view to expediting the vetting processes of the applications.

Spectrum

10. *Regulators are recommended to release additional, critically-needed spectrum for wireless broadband, including opening white spaces to unlicensed use and conducting incentive auctions. Policies should encourage harmonization of international spectrum and communications device approvals.*

11. To support the rapid development of mobile broadband services, we have been mindful of making available the appropriate spectrum and releasing it to the market in a timely manner. Since 2009, the Government have conducted five spectrum auctions and released a total of 220 MHz of radio spectrum in the market. Another 50 MHz of spectrum in the 2.5 and 2.6 GHz band will be released to the market early next year through auction. As an ancillary measure, we will continue to

allow mobile carriers to use hill-top sites and deploy government facilities (such as footbridges and flyovers) for installing base stations to extend their mobile broadband coverage.

12. To ensure the orderly development of new services and to minimise interference, we will continue to coordinate the use of radio spectrum for broadcasting and telecommunications services with neighbouring authorities. In relation to communications device approvals, we will continue to implement the Mutual Recognition Arrangement ("MRA") for telecommunications equipment led by the Asia Pacific Economic Cooperation ("APEC") Telecommunications and Information Working Group.[8]

Network Neutrality, Market Power and IP Interconnection

13. *Regulators are recommended to (i) implement measures to oversee the traffic management techniques used by network operators and ensure that such techniques do not unfairly discriminate among market players; (ii) ensure that communications providers do not engage in conduct that constrains the provision of cloud services for reasons that are not transparent, objective, non-discriminatory and proportionate; and (iii) ensure that all users derive maximum benefits in terms of choice, price and quality of service and to minimise any distortion or restriction of competition.*

14. The issue of network neutrality was discussed by the former Regulatory Affairs Advisory Committee in April 2009 and Members may refer to the previous paper for details.[9] In Hong Kong, there is sufficient facilities-based competition in the telecommunications market and end users have plenty of choices to select their preferred network for

[8] APEC Tel MRA is a voluntary arrangement intended to streamline the conformity assessment procedures for a wide range of telecommunications and telecommunications-related equipment and thereby facilitate trade among the APEC economies. It provides for mutual recognition by the importing economies of conformity assessment bodies and mutual acceptance of the results of testing and equipment certification procedures undertaken by those bodies in assessing the conformity of equipment to the technical regulations of importing economies.

[9] http://tel_archives.ofca.gov.hk/en/ad-comm/raac/paper/raac02_2009.pdf.

accessing various kinds of services and content. The competitive nature of the telecommunications market in Hong Kong has the ability to restrain carriers from acting unilaterally to violate the principle of network neutrality or engaging in anti-competitive behaviour. In the event that the market cannot solve a problem associated with network neutrality or any market player engages in anti-competitive behaviour, we will not hesitate to enforce the competition provisions under the Telecommunications Ordinance ("TO")[10] as well as the licence condition on interconnection.

15. Telecommunications carriers are obliged under licence condition to interconnect their services and networks with each others' to ensure any-to-any connectivity.[11] Terms of interconnection between carriers may be established by (a) bilateral agreement as a result of commercial negotiations between the carriers; (b) tariff published by the carrier which is open to all parties seeking to interconnect; or (c) determination made by the CA under section 36A of the TO. Under Hong Kong's longstanding market-driven policy over the telecommunications industry, most interconnection terms are determined by the interconnecting parties through commercial negotiations. As a matter of fact, no determination on the level of interconnection charge has been made under section 36A of the TO after May 2010. We consider that market forces have served well to resolve interconnection issues as well as safeguard market competition and consumer interests. The competitive market situation has prompted us to conduct a consultation recently on whether we should withdraw the regulatory guidance on interconnection charges between fixed carriers, which are the only type of carrier-to-carrier interconnection charges still subject to regulatory guidance nowadays.

[10] Section 7K on anti-competitive practices, section 7L on abuse of position and section 7N of non-discrimination

[11] Under Special Condition ("SC") 3.1 of the Unified Carrier Licence ("UCL"), A2A Connectivity means that any customer in any one network can have access to any other customer in any interconnecting network and, where directed by the CA, to any service offered in any interconnecting network. While SC 3.1 of UCL is applicable to all types of telecommunications services, the CA has so far applied the requirement of A2A Connectivity to only voice services.

16. While the market has been functioning well, we remain vigilant about the challenges to be brought about by the advent of next generation network ("NGN"). After the completion of a consultancy study in relation to the implications of NGN development on our regulatory regime, the NGN Working Group is now deliberating on, among others, interconnection issues pertinent to NGN.

Market Definition in a Converged Cloud

17. *Regulators are recommended to consider adopting a light-touch approach to new ICT players (such as content and application providers), taking into account network and service convergence as well as encouraging competition.*

18. Service providers may provide public telecommunications services in Hong Kong by making use of cloud services provided by third parties, instead of establishing and maintaining the means themselves. This kind of telecommunications service providers are hereinafter referred to as Cloud Telecommunications Service Providers ("CTSPs"). Since CTSP does not establish or operate the cloud infrastructure but simply makes use of cloud services provided by third parties to provide public telecommunications services, this CTSP is not considered as having "established and maintained" the cloud infrastructure for provision of telecommunications services. If the CTSP has established and maintained telecommunications means, other than the cloud infrastructure, in Hong Kong for provision of public telecommunications services,[12] it will be required to apply for a carrier licence or services-based operator licence. If the CTSP does not establish or maintain any telecommunications means in Hong Kong, it will be regulated under the Class Licence for Offer of Telecommunications Services, created under section 8(1)(aa) of the TO.[13] Content provided

[12] For example, if the service to be provided by the CTSP requires interconnection with the telecommunications networks in Hong Kong, the CTSP may need to establish and maintain its own telecommunications means. Under section 8(1)(a) of the TO, a telecommunications licence is required for the establishment or maintenance of any telecommunications means.

[13] Under section 8(1)(aa) of the TO, a telecommunications licence is required for the offer of

over the public Internet is subject to regulation by general laws only, such as Control of Obscene and Indecent Articles Ordinance.

19. The aforementioned light-handed licensing approach should facilitate the provision of various types of telecommunications services over cloud and ultimately provide more choices of service providers and offerings to consumers. In fact, we also adopt this light-handed licensing approach for communications applications readily available over the Internet for use by the general public. These communications applications are not subject to licensing requirement in Hong Kong if no telecommunications means are established or maintained in Hong Kong.

Cloud Transparency and Quality of Service and Experience ("QoSE")

20. *Regulators are recommended to ensure that Internet service providers provide customers with greater transparency about their traffic management practices, and ensure the publication of comparable information on the availability and QoSE. Service providers should specify transparent and clear terms and conditions in contracts signed with customers.*

21. With a view to providing guidance to broadband service providers on how they may implement fair usage policy ("FUP") and enhancing transparency of service information such that consumers can make informed choices, we promulgated a set of mandatory guidelines on FUP in November 2011 for compliance by service providers.[14] One of the guiding principles is that service providers shall clearly advise customers before any contract is concluded whether their service plans are subject to FUP, and if so, the triggering mechanism and the forms of restrictions applicable. The FUP guidelines have taken effect in February 2012 and we will continue to monitor compliance by broadband service providers.

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telecommunications service.

[14] http://www.coms-auth.hk/filemanager/statement/en/upload/38/gn_201124e.pdf.

22. In a fully liberalised and competitive market, we consider that the level of broadband service quality should be determined by the market instead of the regulator. Broadband service providers are expected to continue to improve their service quality in order to remain competitive in the market. On the other hand, there is a need to provide consumers with sufficient and clear information about the service quality to facilitate them to make informed purchasing decisions regarding fixed and mobile broadband services. As such, we have developed a scheme under which both fixed and mobile broadband service providers are required to publish their performance pledges and actual performance statistics on their websites on a quarterly basis. Service providers are held fully responsible for the veracity of the information they publish.

23. In relation to service contracts, we have issued a code of practice in February 2010 to provide the industry with guidelines on what constitutes a fair, balanced and reasonable service contract. Drawing reference from the code, the Communications Association of Hong Kong ("CAHK") issued an industry code in December 2010 and put it into effect in July 2011. We will continue to work closely with CAHK to ensure effective implementation of the industry code.

Consultative Process

24. *Regulators are recommended to conduct consultation and multi-stakeholder forum.*

25. It has been our longstanding practice to consult the relevant stakeholders before a decision is made to change our existing telecommunications regulatory framework or to introduce new measures. In addition to conducting public or industry consultations, we also consult through the advisory committees established under OFCA, namely the TRAAC, the Radio Spectrum and Technical Standards Advisory Committee as well as the Telecommunications Users and Consumer Advisory Committee. To ensure transparency of the consultation exercises, consultation papers, submissions as well as the final statements

are published on our website. The discussion papers as well as meeting minutes of the advisory committees are also published on our website. Interested parties are also welcome to participate on request in these committee meetings as observers.

(II) Aspects Not Relevant to Telecommunications Regulations

26. Some aspects in the ITU Best Practices, such as "Awareness Raising and Promotion of Uptake by the Public Sector", "Cloud Standards", "Data Portability" and "Demand Stimulation" fall outside the scope of telecommunications regulation and are relevant to the works being undertaken by the Office of Government Chief Information Officer ("OGCIO") in relation to cloud development, which will be explained in paragraph 27 below. The aspect of "Privacy and Data Protection" falls under the ambit of the Privacy Commissioner for Personal Data ("PCPD"). We have therefore sent the ITU Best Practices to these two agencies for their reference.

Initiatives on Cloud Undertaken in Hong Kong

27. In the past year, various initiatives have been kicked off by the Government and the industry with a view to facilitating the development of cloud computing and cloud services in Hong Kong. The following are some of the examples –

(a) In April 2012, OGCIO set up an Expert Group on Cloud Computing Services and Standards ("EGCCSS"),[15] with the objectives to draw expertise from the industry, academia, community and the Government to facilitate and drive cloud computing adoption and deployment in Hong Kong as well as facilitate exchanges among cloud experts both within Hong Kong and with the Mainland. Three working groups have been formed under EGCCSS, namely:

[15] http://www.ogcio.gov.hk/en/about_us/committees/egccss/egccss_tor_membership.htm.

- Working Group on Cloud Computing Interoperability Standards;[16]
- Working Group on Cloud Security and Privacy;[17] and
- Working Group on Provision and Use of Cloud Services.[18]

(b) With a view to strengthening co-operation of Hong Kong and Guangdong in promoting the development of cloud computing and formulation of relevant standards and practices, the Hong Kong / Guangdong Expert Committee on Cloud Computing Services and Standards was set up in July 2012 under the Hong Kong / Guangdong Expert Group on Co-operation in Informatisation.[19]

(c) The PCPD has issued in November 2012 an information leaflet to advise organisations, which are considering engaging cloud computing, on the factors they should consider and explain the relationship between cloud computing business model and the Personal Data (Privacy) Ordinance.[20]

(d) Six industry bodies in Hong Kong (including CAHK) have formed the Hong Kong Cloud Standards Alliance in April 2012, with the objectives to set standards and best practices of cloud computing including interoperability and to foster cooperation with the Mainland.[21]

(e) In relation to security issues, the Cloud Security Alliance set up the Hong Kong and Macau Chapter in May 2012, with the objectives to promote the use of best practices for providing security assurance within cloud computing and facilitate cloud security awareness and education.[22]

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16 http://www.ogcio.gov.hk/en/about_us/committees/egccss/wgccis_agenda_papers.htm.
17 http://www.ogcio.gov.hk/en/about_us/committees/egccss/wgcsp_agenda_papers.htm.
18 http://www.ogcio.gov.hk/en/about_us/committees/egccss/wgpucs_agenda_papers.htm.
19 http://www.info.gov.hk/gia/general/201207/17/P201207170223.htm.
20 http://www.pcpd.org.hk/english/publications/files/cloud_computing_e.pdf.
21 http://www.asiacloudforum.com/content/6-it-bodies-form-hong-kong-cloud-standards-alliance.
22 https://chapters.cloudsecurityalliance.org/hongkongmacau.

28. Apart from the adoption of cloud services by some large corporations, the Government also targets to launch the Government Cloud (GovCloud) service by end of 2013.[23] According to the Cloud Readiness Index published by Asia Cloud Computing Association, Hong Kong ranked third among the 14 Asia Pacific economies under comparison in 2012 (see the table).[24]

Cloud Readiness Index (2012)

	Data Privacy	International Connectivity	Data Sovereignty	Broadband Quality	Government online servives and ICT Prioritization	Power Grid and Green Policy	Intellectual Property Protection	Business Sophistication	Data Center Risk	Freedom of Information Access	Cloud Readiness Index	Rank	Change since 2011
Japan	**9.0**	**10.0**	5.6	7.6	7.9	7.8	7.6	**8.4**	6.0	**8.9**	78.8	1	▬
Korea	**9.0**	8.0	6.2	**9.0**	9.1	7.1	5.9	6.9	7.4	7.7	76.3	2	▲
Hong Kong	7.5	7.4	7.6	7.6	8.4	5.7	7.9	7.1	**8.0**	8.7	75.9	3	▼
Singapore	4.5	9.2	**8.1**	6.3	**9.5**	5.7	**8.7**	7.3	6.4	7.1	72.8	4	▼
Taiwan	7.0	7.5	5.9	6.1	8.8	7.1	7.1	7.5	6.5	**8.9**	72.4	5	▬
New Zealand	**9.0**	1.3	**8.1**	5.4	7.8	**8.3**	8.3	6.6	7.1	**8.9**	70.8	6	▬
Australia	7.5	2.7	7.3	6.0	8.2	7.5	7.6	6.7	5.6	8.6	67.7	7	▼
Malaysia	7.5	4.6	5.6	3.7	8.2	6.2	7.0	7.1	6.2	6.9	63.0	8	▼
India	6.0	8.4	4.7	2.4	6.3	3.3	5.0	6.1	3.1	7.6	52.7	9	▬
China	4.0	5.0	3.5	3.5	6.6	4.5	5.7	6.2	5.1	7.1	51.2	10	▼
Indonesia	6.0	4.8	2.1	2.2	5.7	4.9	5.1	6.0	3.1	7.2	47.1	11	▬
Philippines	2.5	4.6	4.3	2.3	5.5	5.8	4.0	5.9	3.6	7.5	46.0	12	▲
Thailand	3.0	2.8	1.5	5.9	5.5	4.8	4.4	6.0	3.6	7.4	44.9	13	▼
Vietnam	5.0	3.2	3.9	2.2	5.9	3.8	3.6	5.3	5.4	6.6	44.9	13	▼

Source: Asia Cloud Computing Association

[23] The Government Cloud (GovCloud) platform provides server, storage and network resource to support common e-government services for use by bureaus and departments. Further information of GovCloud is available at http://www.ogcio.gov.hk/en/strategies/government/cloud_strategy/develop_gov_cloud.htm.

[24] http://www.asiacloud.org/images/stories/contents/files/CRI_2012.pdf.

Conclusion and Way Forward

29. In this paper, we have made an attempt to benchmark our telecommunications regulatory measures adopted in Hong Kong against the ITU Best Practices. We conclude that our existing telecommunications regulatory measures have by and large fulfilled the ITU Best Practices. That said, we will continue to keep track of the ongoing discussions and works undertaken by ITU as well as other relevant international organisations in facilitating the development of cloud computing and cloud services, and take all necessary actions in a timely manner in order that we may keep abreast with the international best practices.

Views Sought

30. Members are invited to give their views and comments on telecommunications regulatory measures for further facilitating the development of cloud computing and cloud services in Hong Kong.

Office of the Communications Authority
December 2012

Annex

GSR12 BEST PRACTICE GUIDELINES ON REGULATORY APPROACHES TO FOSTER ACCESS TO DIGITAL OPPORTUNITIES THROUGH CLOUD SERVICES*

The growth of cloud computing has the potential to offer tremendous cost savings, efficiency and innovation for government, businesses and individuals around the globe. For entrepreneurs and businesses, big and small, cloud computing delivers unique economic leverage that means investment can translate into impressive returns and costs savings. With the advent of cloud computing, digital resources are now becoming accessible over multiple networks anywhere, anytime. Yet, reaping the full potential of cloud computing requires cooperation and collaboration between governments, industry and consumers to build confidence in cloud-based services. Importantly, the growth of cloud computing will depend on ubiquitous and affordable broadband networks to which service providers have access on a non-discriminatory basis.

We, the regulators participating in the 2012 Global Symposium for Regulators, recognize that effective and dynamic regulation can facilitate cloud computing uptake and allow it to thrive and act as catalyst for economic growth. Therefore, we have identified and endorsed these regulatory best practice guidelines to promote innovation, investment and competition in cloud infrastructure and services, and protect consumer interests.

Awareness raising and promotion of uptake by the public sector: Cloud services and the opportunities and savings they make available to governments around the world should be actively pursued and promoted. Bringing awareness of these opportunities will generate economic opportunities and provide great value to citizens, consumers and businesses.

Broadband infrastructure: Regulators need to work to reduce barriers to broadband deployment, actively facilitate build-out of national fibre-optic networks and international connectivity links, including submarine cables, and promote infrastructure sharing and coordination of civil works, including across sectors, as well as policies to speed rights of way access, and installing data-centre infrastructure. This will provide incentives for content delivery networks and data-center companies to install locally. It is also necessary to ensure the deployment of services in unserved and underserved areas, including emergency and accessibility-enhanced services.

IP interconnection: Regulators should seek to ensure that all users derive maximum benefit in terms of choice, price and quality of service and to minimize any distortion or restriction of competition.

Spectrum: For the future of cloud computing services, several actions could be taken to release additional, critically-needed spectrum for wireless broadband, including repurposing spectrum, opening white spaces to unlicensed use, or conducting incentive auctions. In addition, policies that generally encourage the harmonization of international spectrum and communications device approvals must be encouraged.

Market definition in a converged cloud: Taking into account network and service convergence, promoting migration to NGN and encouraging competition, regulators may consider adopting a light-touch approach to new ICT sector players, such as content and application providers, while carefully assessing the impact of their decisions on all market players.

Market power: Regulators need to ensure that communication providers do not engage in conduct that constrains the provision of cloud services for reasons that are not transparent, objective, non-discriminatory and proportionate.

Enforcement: Regulators need to establish a means of identifying breaches to ensure they are able to respond effectively. This may be achieved through (1) self-regulatory mechanisms, content service providers notifying the appropriate regulator of breaches of security, (2) ideally changes to certain aspects of data protection legislation which is impossible to monitor and hence unenforceable in practice; and (3) mechanisms for complaint handling and resolution of disputes, including alternative dispute resolution mechanisms, which are effective, fair,

proportionate, protecting the rights of all stakeholders and conducive to cooperation among them.

Cloud transparency: Regulators may consider encouraging cloud service providers (CSPs) or introducing specific obligations with regard to notifying users of the chain of providers that underpin the provision of cloud services. Regulators also need to ensure that ISPs provide customers with greater transparency about the traffic management practices being followed by companies on their networks.

Consultative process: Regulators need to consult with CSPs and other market players about the appropriate regulatory treatment and classification of certain cloud services, with a view to issuing guidance providing legal certainty for market entrants and cloud users, for example through conducting multi-stakeholder fora to develop best practices for protecting consumers.

Net neutrality: A certain level of traffic management is necessary to minimise network congestion. Regulators and policy makers should seek to implement measures to oversee the use of traffic management techniques to ensure that those do not unfairly discriminate between market players.

Regulators also need to review existing competition laws to determine whether the regulatory tools, such anti-discriminatory law or regulations that are already in place adequately address the competition issues that tend to impact net neutrality.

Quality of service and experience (QoSE): A number of regulators enforce minimum QoSE requirements to ensure that customers and edge providers have reliable and uninterrupted services, including access to personal information in the cloud. In order to deliver these services, network and service providers will have to ensure transparent and clear terms and conditions of contracts signed by costumers. Regulators also need to ensure the publication of comparable information on the availability and QoSE and, when necessary, introduce minimum requirements for QoSE in order to avoid degradation of the quality provided to customers.

Consumer empowerment: Policymakers need to ensure that consumers are empowered to control their personal data and protect their privacy through facilitating Cloud Literacy. Cloud users need to be sure that

information stored or processed in the cloud will not be used or disclosed in harmful or unanticipated ways.

Privacy & data protection: International agencies as well as national policy makers and regulators must work together to develop efficient, effective, proportionate and readily enforceable laws to protect consumers' reasonable expectation of privacy. Responsibility should also be devolved to stakeholders developing self-regulation, for example establishing privacy policies that are transparent and appropriate for the services they provide. Governments should also continue to work together to ensure no single entity adopts privacy regulations that are so burdensome that they restrict the free flow of information or prevent CSPs from maximizing the cost saving inherent in those services.

Cloud standards: The development and widespread adoption of appropriate national, regional and international technical and organizational standards are required to address a range of concerns among cloud providers and users, including the integration of legacy systems with cloud interfaces; data and application portability and security.

Data portability: Proprietary cloud computing application programming interfaces (APIs) can limit customers' ability to switch to a different provider (lock-in effect). Standardizing APIs would facilitate data portability and would allow greater reliability by allowing the same functions to be performed by multiple cloud computing providers.

Interoperability: Interoperability is key for consumers of cloud computing services as it facilitates information flows with appropriate security and privacy protections. Therefore, governments need to support the development of standards and measures that will speed the arrival to markets of communications devices and ensure seamless wireless connectivity and services. Eliminating unnecessary restrictions on the trans-border flow of data is of particular importance.

Demand stimulation: Governments must lead the way in the adoption of cloud-based computing. In addition, efforts need to be deployed to overcome barriers to broadband adoption, pursuing multiple initiatives targeted at both consumers and small businesses.

Capacity building: As cloud computing is expected to be one of the main drivers of future growth of digital economies, regulators and policy

makers can actively contribute to the development of a new generation of educated and technology-savvy workforce by ensuring the timely and effective introduction and spread of new and improved products and processes in the economy, reinforcing the ability of individuals and businesses to continuously create wealth, and putting a premium on all forms of learning, with close attention to both indigenous knowledge and the transfer of knowledge.

Research and development (R&D): Promoting R&D activities in the field of cloud computing is an essential tool for designing future-proof digital economies. Close regional and international cooperation with relevant international bodies as well as universities should be encouraged.

Regulatory cooperation: Cloud services impact on a range of regulatory areas, both within jurisdictions and across multiple jurisdictions. Regulators should cooperate and coordinate regulatory decision-making that is targeted at CSPs.

Internationally, governments need to collaborate to increase regulatory predictability related to the cloud and develop common core policy principles that will assist the development and adoption of cloud computing services while avoiding the creation of regulatory barriers to market entry.

Regional cloud: Regional clouds represent a unique opportunity for a group of countries to cooperate in order to promote cloud computing services and take advantage of its benefits while reducing security, confidentiality and other vital concerns through the establishment of regional regulatory frameworks and other protective measures for businesses and consumers.

To that end, a sub-regional approach could be encouraged whereby regulators' associations promote efforts to harmonize regulatory instruments among their member countries.

* The Guidelines are based on contributions from Algeria, AREGNET/Lebanon, Burkina Faso, Colombia, Egypt, France, Mauritius, Poland, Sri Lanka, Sudan, Swaziland, Switzerland, Thailand, United States, and Zimbabwe

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