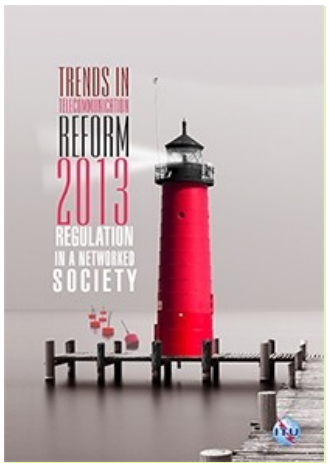
GSR 2012 Discussion Paper

Net neutrality: A regulatory perspective



Work in progress, for discussion purposes

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1 NET NEUTRALITY: A REGULATORY PERSPECTIVE

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Summary

This paper considers net neutrality – the principle that all electronic communication passing through a network is treated equally – in the context of an environment where traffic management, in varying forms and in varying degrees, is ubiquitous. It sets out an overview of these traffic management measures and the factors driving their use. That not all of these measures – despite each contravening a pure concept of "neutrality" – are considered problematic suggests that concerns over the particularly controversial measures may instead stem from a broader issue, such as non-discrimination or the appropriate use of market power.

To the extent that some traffic management practices do raise potential concerns, the regulatory response should be – as it is with all issues – proportionate and evidence-based. In practice, this is likely to mean that reliance on existing regulatory frameworks and market-based mechanisms is an appropriate initial response in many instances. If harmful traffic management continues, refinements may be necessary, particularly to improve transparency and reduce switching costs for consumers and, potentially, introduce powers to restrict specific behavior such as blocking and unreasonable discrimination. A representative study of jurisdictions where net neutrality issues have been prominent is consistent with this approach, and this paper categorizes these graduated responses to net neutrality issues as:

- **Cautious observation**: countries that have taken note of net neutrality issues and have currently chosen not to take any specific measures to address these issues;
- **Tentative refinement**: countries that have adopted a light handed approach, with some refinements to the existing regulatory regime governing communications services, but not going so far as to prohibit certain behaviors; and
- **Active reform**: countries that have gone further and sought to prohibit specific behaviors by ISPs, often subject to reasonable network management practices.

Beyond this framework, the paper considers contextual factors that affect how net neutrality is treated under existing – and potential future – regulation, including the industry's response to net neutrality concerns, the International Telecommunications Regulations, the relevance of investment and future regulatory and business models. As much as possible, reference has been made throughout this paper to the research and empirical findings by national and international ICT regulators, including the Body of European Regulators for Electronic Communications (BEREC), the European Commission, the Federal Communications Commission (FCC), Ofcom and others.

This paper fleshes out the net neutrality debate in an effort to provide national ICT regulators with information and tools to address net neutrality and traffic management in their home jurisdictions. This discussion will conclude with recommendations and a checklist of best practices to guide national regulators, in both developed and developing countries, as they navigate a debate which, despite being centered on neutrality, has seen a remarkable level of polarization.

1 Net neutrality and traffic management

There is a general consensus that there is no one, commonly accepted, definition of net neutrality. This section will present some of the more widely used interpretations of net neutrality and describe the traffic management measures taken by ISPs that contradict the purest ideal of a neutral network.

1.1 What is net neutrality?

In the absence of a standardized definition of net neutrality, BEREC has used the following description of net neutrality:

A literal interpretation of network neutrality, for working purposes, is the principle that all electronic communication passing through a network is treated equally. That all communication is treated equally means that it is treated independent of (i) content, (ii) application, (iii) service, (iv) device, (v) sender address, and (vi) receiver address. Sender and receiver address implies that the treatment is independent of end user and content/application/service provider[2]*.*

Another definition, by Tim Wu, has been described by BEREC as "one of the most famous":

Network neutrality is best defined as a network design principle. The idea is that a maximally useful public information network aspires to treat all content, sites and platforms equally. This allows the network to carry every form of information and support every kind of application.[3]

Other net neutrality proponents argue that net neutrality means ensuring that all services are provided to all parties over the same quality of Internet pipe, with no degradation based on the service chosen by the end user and at the same cost. This definition is based on the assumption that data is transmitted on a "best efforts" basis, with limited exceptions.[4]

1.2 Traffic management: a threat to net neutrality?

1.2.1 What is traffic management?

These broad definitions of net neutrality are being challenged by the reality of an Internet which does require some traffic management to ensure efficient operation for all users and to prevent degradation of service. Traffic management is now widespread and generally accepted, including by BEREC, as a necessary tool that can benefit both content and application providers (CAPs) that rely on the public internet and the end users that expect a QoS when they surf the internet. As BEREC put it, in reference to the above definition:

There have been and continue to be deviations from this strict interpretation. Some of these deviations may well be justified and in the interests of end-users but other forms could cause concern for competition and society. To assess this, NRAs will need to consider a wider set of principles and regulatory objectives.[5]

Most ISPs now have equipment in place that can detect what customers are using their connections for. They can tell the number of websites that a customer visits, or whether those customers are using their connection for online gaming or video streaming, or for other peer-to-peer software, such as Skype or BitTorrent. It is now common for ISPs to direct speeds or bandwidth to different types of applications, making one, such as e-mail, faster while slowing another, such as BitTorrent.

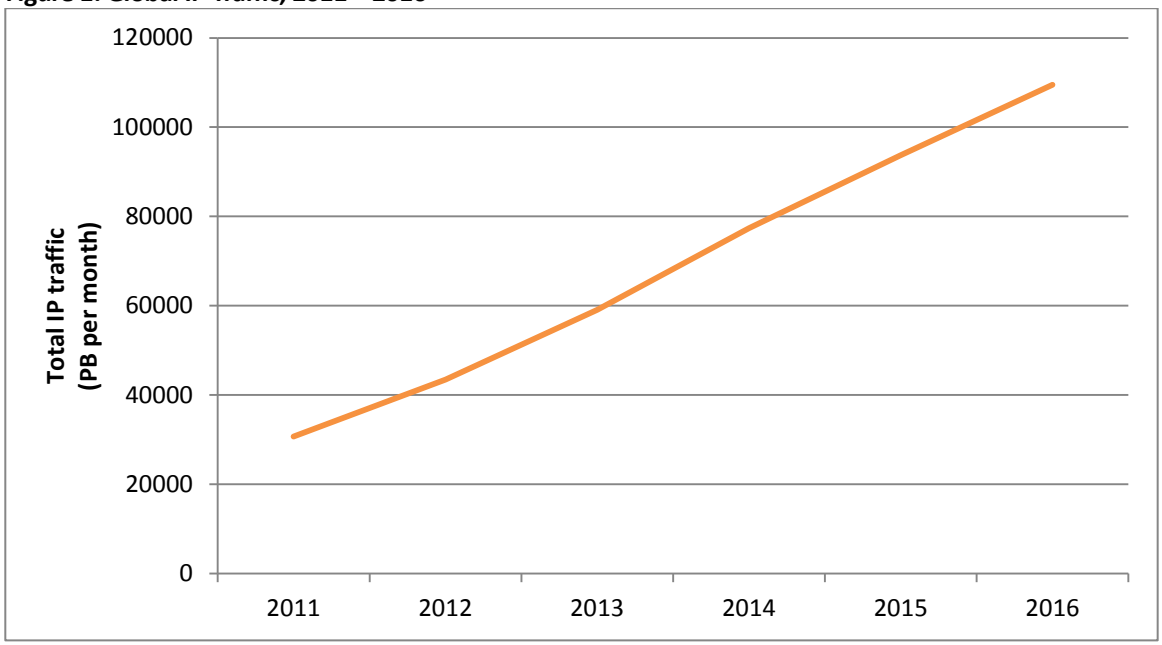
Traffic management can be broadly defined as a collection of techniques that may be used by an ISP to plan and allocate available resources to attain optimum performance for diverse classes of users across a network. These

techniques will often include the use of performance measures to define optional service levels tailored to different user needs, and to assure appropriate quality of service. Traffic management is critical for the proper functioning of the Internet, but it can also be misused by an ISP to create unfair access or use of the Internet.[6]

1.2.2 Reasons for traffic management

The primary reason that is given by ISPs for traffic management is to prevent a small number of their customers from clogging up access to the Internet by using a disproportionate share of the available bandwidth. In this way, proponents of traffic management say that ISPs are justified in controlling the flow of data because it is necessary to maintain the quality of service that is required to ensure all users have an enjoyable browsing experience. Figure 1 illustrates the exponential growth in global IP traffic that is forecast to take place in the coming years.

Figure 1: Global IP Traffic, 2011 – 2016



Source: Cisco, 'Cisco Visual Networking Indexing: Forecast and Methodology, 2010-2016' (30 May 2012), 6.

This forecast rise in demand has significant implications for ISPs and, upstream, wholesale service providers and network operators. The two most obvious likely responses to this growth are traffic management, to manage a greater amount of data using a similar level of capacity, and/or additional investment in upgrades to increase the total network capacity. It is worth pausing to consider that these options, while rational, would not ordinarily be the first-choice response of a generic firm facing a considerable increase in demand. In almost any other industry, a substantial rise in demand would be met with glee and a similarly substantial rise in price (at least until new entrants could enter the market). ISPs are suppliers in a market where prices have dropped over time even as demand and quality has improved; leaving ISPs in the somewhat unique position of facing strong growth forecasts, not with anticipation but with an apparent air of trepidation.

Much of the strongest concern relates to convergence, which has seen ISPs and CAPs increasingly crossing into the traditional territory of the other. CAPs, like Skype and Viber, offer VoIP services that can act as a substitute for the voice telephony services of ISPs that carry their content. Conversely, some ISPs have begun to provide IPTV services that compete with the content of broadcaster CAPs.

This increasing competition can provide incentives for ISPs with significant market power (SMP) to misuse that market power and limit competition from CAPs through discriminatory activities, such as blocking and throttling of the competitive service, in favor of the ISP's own product. ISPs have a key intermediary role between CAPs and end users; neither can reach the other online except through an ISP.

An ISP pre-determining the rate of throughput based on data type contravenes the principle of equal treatment of data. The primary justification for prioritization is to ensure that key services, such as business or other critical services, have reliable access to the network. However, the ability to differentiate between data types also raises the possibility of more questionable discriminatory behavior, which may arise when ISPs have an incentive to prioritize their own services or applications for their own benefit.

The broad recognition of the need for at least some traffic management measures poses difficulties for bright-line regulation; it may not be easy for regulation to clearly and preemptively distinguish between "reasonable" traffic management and measures that justify regulatory intervention.

This section of the paper sets out a more comprehensive list of the range of traffic management techniques available to ISPs, including those generally viewed as innocuous. Although some of these actions will raise more concerns than others, the intent behind listing them is not to enable the sketching of a line demarcating "reasonable" from unacceptable traffic management. The appropriateness of a particular action by an ISP should be considered on its facts, not by its categorization. This paper sets out these traffic management measures for two reasons: first, to inform and set the context for the discussion that follows; and second, to illustrate the ubiquity of traffic management against pure net neutrality.

1.2.3 Traffic management techniques

- **Data caps**: A wide variety of data caps and "fair use" policies may be used by operators to implement a specific business model. In general, a data cap will be imposed to support the operator's pricing strategy, so that the price of traffic is based on volume.

  Data caps are a technical measure that requires monitoring traffic volume and throttling data or charging for extra volume once a pre-defined data cap is reached. Data caps provide a price signal to end users in relation to the cost of their bandwidth consumption. Once a data cap has been reached, several measures may be applied:

  - a speed limit may be activated (e.g. restricting transmission data down to a pre-determined transfer rate);
  - access to the network may be temporarily stopped or suspended; or
  - customers may be given an opportunity to buy extra data volume.[7]

  Data caps tend to be applied indiscriminately. As such, BEREC have argued that limiting data volume or the rate of throughput independent of data types does not technically conflict with the principle of net neutrality.[8] It is only when specific restrictions are tied to the cap as an incentive to attract customers that a data cap may present a problem.

- **Application-agnostic congestion management**: To respond to network congestion, an ISP can react to daily fluctuations or unexpected network environment changes by implementing "congestion controls" at the edge of the network, where the source of the traffic (e.g. computers) slows down the transmission rate when packet loss is occurring. [9]

- **Prioritization:** An ISP might prioritize transmission of certain types of data over others (most often used to prioritize time-sensitive traffic, such as VoIP and IPTV). ISPs may be required to prioritize emergency services, and this is generally not a concern from a net neutrality perspective.

- **Differentiated throttling**: The capacity available for a particular type of content (most often peer-to-peer traffic, particularly in peak times) may be restricted, which preserves capacity for the un-

restricted content. Unlike application-agnostic congestion management, this technique is aimed at a specific type of content; generally a type that is bandwidth-hungry and non-time-critical.

- **Access-tiering:** An ISP may prioritize a specific application or content – for a price to be paid by a CAP. By selling access to a "lane", access providers can generate greater revenue to fund the network investments necessary to handle increasingly bandwidth-hungry services.

  This can be distinguished from prioritization in that access-tiering is typically open to all service providers (that can afford to pay for it) and that it is generally used to promote a particular service provider, rather than a type of content.

  Access-tiering has been criticized for its potential harms to innovation, particularly to start-ups unable to afford the fee. It is also commercially possible that a service prioritization arrangement could be made on an exclusive-by-service basis, to prevent competitors of the preferred CAP from purchasing a similar level of priority.

- **Blocking:** End users may be prevented from using or accessing a particular website or a type of content (e.g., the blocking of VoIP traffic on a mobile data network). Blocking may be implemented to:

  - inhibit competition, particularly if the access provider offers a service that competes with the service being blocked;

  - manage costs, particularly where the cost of carrying a particular service or type of service places a disproportionate burden on the access provider's network; and

  - block unlawful or undesirable content, such as child abuse, viruses or spam. This may be necessary to comply with government or court orders, or done at the request of the end user. The blocking of unlawful and undesirable content generally raises few net neutrality concerns. Lawful interception measures, while not constituting "blocking", are similarly non-controversial from a net neutrality perspective.

Specific restrictions may be applied discriminately or indiscriminately between users and they may be permanent or implemented over certain periods (e.g. peak time). The nature of the restriction will often be contractually disclosed by the ISP, so that the user is made aware that their access to a particular service will be restricted in certain circumstances.

1.2.4 Traffic management concerns

All of these measures are, in a sense, "non-neutral": they mean that different traffic passing through a network is treated differently. The fact that some of these measures have been accepted, even welcomed, while others have been criticized or subject to sanctions, suggests that concerns over these "problematic" categories are derived not so much from their departures from a truly neutral network, but from something broader, such as their departures from the principles of non-discrimination and fair competition (including the abuse of market power).

In particular, the use of traffic management by an operator for anti-competitive purposes by using its control over internet access to discriminate against any competitors that rely on its network has been the subject of greatest concern. As critics point out, that there is a fine line between correctly applying traffic management to ensure a high quality of service and wrongly interfering with Internet traffic to limit applications that threaten the ISP's own lines of business. This discrimination could be through:

- the use of **blocking** technology to completely prevent access to, or use of, a rival's content or application;

- **throttling** a rival's content or application so that the ISP's own service is more attractive in comparison, or conversely, **access-tiering** the ISP's own content and not permitting the competitor to acquire equivalent prioritization;

- even where **access-tiering** is offered widely, discrimination may be problematic if the terms on which access-tiering is offered treat CAPs differently to each other, or differently to the ISP's equivalent content or application, and those differences are not objectively justifiable (e.g., for cost of technical reasons); or

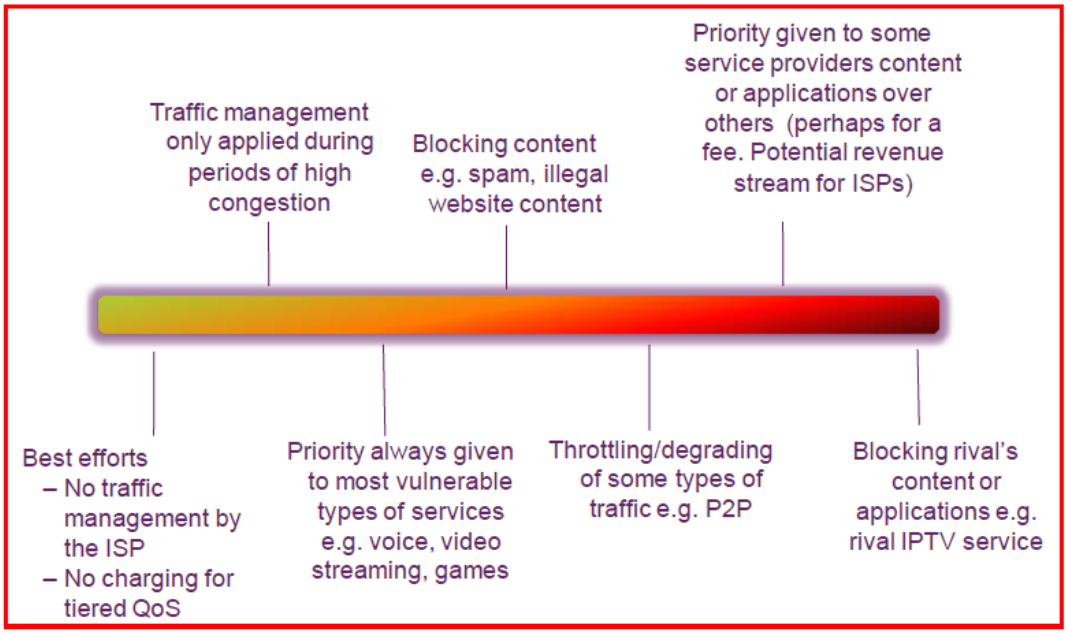
- dedicating so much capacity (either through **access-tiering** or **prioritization**) that the remaining "best efforts" Internet access service is degraded – the so-called "dirt track" issue.

For example, the VoIP application Skype uses peer-to-peer technology to provide free phone calls, which compete directly with the phone services offered by many ISPs. It would be easy at a technical level for an ISP to use its traffic management equipment to limit a customer's Skype experience in an effort to protect its own fixed or mobile telephony services. In BEREC's view, however, blocking VoIP over a mobile network is unlikely to be legitimate from a congestion management perspective. Although the bandwidth required for a VoIP call is roughly 25-30% greater than required for a traditional circuit switched call, and so some capacity is necessary to accommodate VoIP calls, BEREC considered that this use takes up only a small fraction of capacity on the network and so is unlikely to result in a level of congestion that would require traffic management.[10]

In the particular examples to date where intervention has taken place, the intention of the particular measure has been either stated by the parties or the intention of effect has been deemed so obviously inappropriate that regulators and law makers have stepped in. However, intent will often be obscured, and potentially anti-competitive effects difficult to ascertain, making these measures difficult to distinguish from legitimate traffic management policies that can enhance the Internet experience for the vast majority of users. In this regard, moves to regulate and determine appropriate traffic management practices will be particularly challenging.

Ofcom has placed these practices on a spectrum, which shows the progression from traffic management that does not raise concerns (and will generally improve efficiency), to those measures considered more problematic.

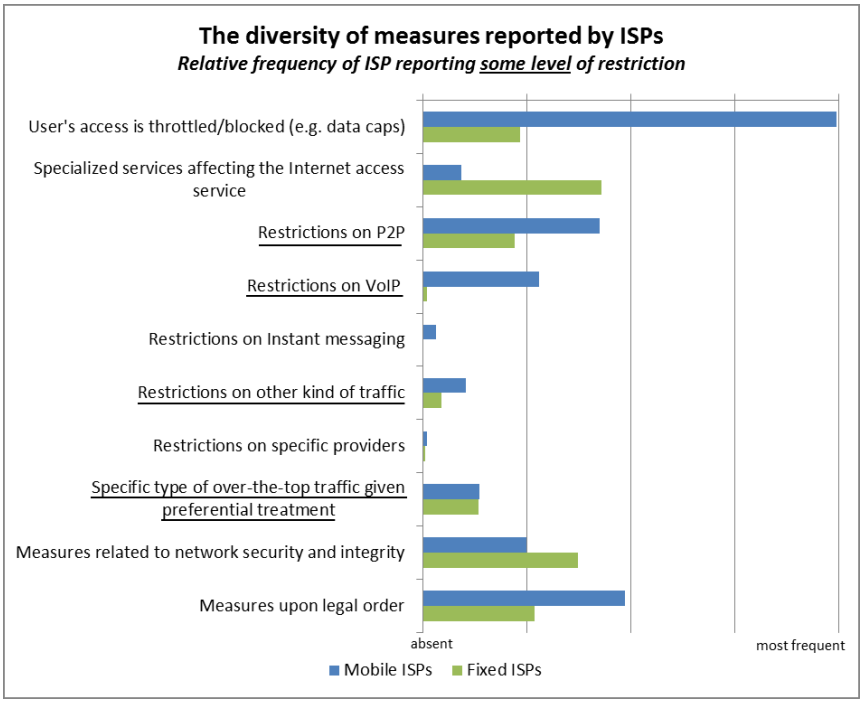
Figure 1: Traffic management conduct



Source: OCFOM, United Kingdom, available online at: *stakeholders.ofcom.org.uk/binaries/consultations/net-neutrality/summary/netneutrality.pdf.*

To give an indication of the popularity of traffic management, Figure 2 provides a broad overview of the traffic management measures that were reported to BEREC in its recent survey of 381 operators (266 fixed and 115 mobile) across Europe. When reading this figure, it is important to note that the frequency of ISPs reporting some level of restriction does not necessarily quantify the number of users that may ultimately be affected by a particular traffic management policy. This would depend on factors such as the size of the ISP or whether the restriction is applied to all users or only to some users, etc. However, what this figure does reveal are the similarities as well as the varying restrictions that may be applied by operators (both fixed and mobile).

Figure 2: Overview of traffic management measures by European operators



Source: BEREC, 'A View of Traffic Management and other Practices Resulting in Restrictions to the Open Internet in Europe' (29 May 2012), 13.

1.3 Traffic management technologies

This section will break down the technical issues related to traffic management to help identify what level of operator control over the network is reasonable (and, in some cases, necessary).

1.3.1 Deep packet inspection

Internet traffic is based on the movement of "packets" of data which contain both content (e.g. voice, email, etc.) as well as other information that identifies where each "packet" has come from and where it is going to (among other things).

At the moment, the most important technology for traffic management is deep packet inspection (DPI). DPI equipment inspects the content of packets travelling over an IP network to identify the application or protocol that is in use, which is done by examining the source and destination IP address, the packet payload and the port number of the packet. DPI has become widely deployed because it allows for a relatively fine-grained discrimination among the applications running on an IP network, which allows an ISP to manage traffic at the level of the individual subscriber.

DPI has evolved over time to the point where it now allows ISPs to identify and control the bandwidth available to certain applications in real-time. This effectively means that a packet relating to a particular application or data type may be identified and managed by the ISP in real-time as it travels across the network. This makes DPI a useful tool for traffic management by an ISP, but it also poses an obvious threat to the principle of net neutrality.[11]

1.3.2 Deep flow inspection

Deep flow inspections (DFI) augment DPI by more accurately identifying underlying applications and protocols. DFI makes inferences based on the behavior of the flow of packets rather than looking for protocol signatures or port usage in individual packets. By looking at traffic characteristics, such as rate, shape, size and duration, and uses in conjunction with port numbers, source or destination address and protocol, DFI is being used more and more by ISPs to improve identification.[12]

1.3.3 Policy control and management

Policy control attempts to define the rules for how services are to be delivered and the conditions under which these services are used. In practice, policy control is a broader set of techniques than DPI in that it attempts to manage traffic flows within a structured and standardized architecture, rather than focusing on the contents of individual packets.[13] For example, an ISP could implement a policy that a particular customer be permitted to download unlimited videos after they subscribed to a premium content package.

Policy tools are able to handle a broader range of management tasks more flexibly than DPI. Furthermore, because policy control is more focused on the subscriber than the application, it allows an ISP to tailor its services to an individual user. For these reasons, there has been a rapid growth in the use of policy control and management technologies in recent years.[14]

2 A regulatory perspective: enforcing the principle of net neutrality

There are a number of issues that policy-makers will need to consider when developing a regulatory regime to govern net neutrality. The first, and most important, issue is whether a regulatory response to deal with traffic management is necessary and, if so, what the response should be. This section discusses the range of approaches observed in a number of countries around the world and tries to group these approaches into three different categories. This section also provides an overview of current approaches and perspectives on net neutrality from five leading jurisdictions.

Each country in the jurisdictional review has viewed the issue of net neutrality with an eye to local circumstances, which has resulted in a tailored application of regulation and policy on a country-by-country basis. This raises the question of whether a common set of international rules or principles are needed to allow for greater cross-border collaboration. The focus to date has clearly been at the national level, but the Internet is essentially a global network, so it seems inevitable that at some point there will be a push to extend the regulation of net neutrality from the national to the international level.

This section concludes with a discussion on some broader issues that will also need to be considered by regulators as they consider net neutrality policies.

2.1 Overview of approaches

We have observed three basic approaches to net neutrality issues in the countries we have studied:

- **Cautious observation**: These countries have taken note of net neutrality issues and have currently chosen not to take any specific measures to address these issues;

- **Tentative refinement**: These countries have adopted a light handed approach, with some refinements to the existing regulatory regime governing communications services, but not going so far as to prohibit certain behaviors; and

- **Active reform**: These countries have gone further and sought to prohibit specific behaviors by ISPs, often subject to reasonable network management practices.

	Cautious observers	**Tentative refiners**	**Active reformers**
Measures taken	No specific measures	Light-handed net neutrality measures: e.g., transparency, lowering switching barriers, minimum QoS	Specific net neutrality measures: e.g., no blocking, no discrimination in treatment of traffic
Example countries	Australia Republic of Korea New Zealand	European Commission Japan United Kingdom	Brazil (bill) Chile France Netherlands Singapore USA (FCC rules)

In those countries that are either cautious observers or tentative refiners, there appears to be a degree of confidence that the existing regulatory regime for communications services is adequate to deal with the challenges of net neutrality, or will be adequate with relatively minor "tweaks". There are strong regulatory regimes in countries that are active reformers, but there have been concerns that the lack of open access policies, or effective application of those policies, may have contributed to holding back the retail broadband market in some countries (e.g., in the United States relative to other countries[15]).

2.2 The first step; a competitive retail broadband market

The ability of an ISP to engage in potentially anti-competitive traffic management, without being disciplined by the market, will depend on the degree of market power that it has. The incentive for an ISP to institute these practices, and the attractiveness of particular types of conduct, are likely to be greater where the ISP supplies services that compete with those of the CAPs (VoIP or IPTV for example).

In a competitive retail broadband market, where no single ISP possesses SMP, end users that are adversely affected by traffic management will shift to an ISP with more favorable traffic management practices (all other things being equal). As a result, these practices are unlikely to be sustainable in the long term.

In many countries around the world, there have been regulatory interventions aiming at controlling market power at a wholesale level and promoting competition at the retail level. Open access policies relating to broadband services, such as mandated local loop unbundling, bitstream access and duct access, have been largely successful in many countries in stimulating retail broadband markets, particularly for fixed broadband. These open access policies usually include a general non-discrimination obligation on firms with market power and have been, on occasion, bolstered further by remedies such as functional and structural separation that aim to further control the likelihood of discrimination.

In the telecommunications sector in many countries, *ex ante* regulation is supplemented by *ex post* competition law. Many of the practices that would infringe on the principle of net neutrality will also be considered anti-competitive conduct if a party, such as an ISP, has a dominant position in the market and has abused this position in the operation of its network.

If the regulatory regime for communications services is working effectively to promote retail broadband competition, with the further backstop of general competition law, then a central issue is whether it is necessary to institute specific measures to deal with the types of discriminatory behavior that infringes net neutrality principles.

It could be said that, generally, the cautious observers have decided that the existing regulatory regime is adequate for now. However, it is not a complacent approach by regulators, but is normally accompanied by a close level of ongoing monitoring and observation of net neutrality concerns, to confirm that confidence in the existing regulatory regime is justified.

2.3 Enhancing competition: transparency and switching costs

In the tentative refiner countries, the decision has been made that reliance on the existing regulatory environment for communications may not be fully adequate for addressing net neutrality concerns. Relatively minor refinements have been made to further improve the operation of retail broadband markets, particularly around transparency, so that end users have accurate and relevant information of the traffic management practices of a particular Internet access service, and reduced switching costs, so that end users can easily leave an unsatisfactory service.

BEREC, for example, has focused particularly on the importance of end users being fully informed of the discriminatory practices and that the costs of switching ISPs are low.

2.3.1 Transparency

The United Kingdom regulator, Ofcom, has given some thought to how best to ensure consumers have access to useful information on traffic management practices. Ofcom has published six principles for the publication of consumer information on traffic management. It suggests that consumer information should be: [16]

- ***Appropriate:*** *ISPs should disclose all information, and only such information, that a consumer needs to make an informed decision.*
- ***Accessible:*** *basic information should be available at the point of purchase, and more detailed technical information should be readily available online or on request.*
- ***Understandable:*** *information should be simple enough for consumers to be able to understand the practical impact of traffic management policies on the way they may use the internet service.*
- ***Verifiable:*** *consumers or third parties (e.g. intermediaries such as price comparison websites) should be able to verify any information provided.*
- ***Comparable:*** *consumers should be able to compare information provided by different providers.*
- ***Current:*** *the information available to consumers should be up-to-date, both at the point of sale and subsequently.*

Principles such as these may be adequately effective as non-binding guidelines, backed up with general consumer protection laws that govern misleading conduct. The relatively light-handed nature of transparency

obligations also means that operators may be more willing to comply on a voluntary basis. Such voluntary co-operation could be seen as driven – at least partially – by a desire to pre-empt more intrusive compulsory restrictions. In the United Kingdom, a number of ISPs developed and launched a Code of Practice on traffic management, cited with approval by Ofcom (referred to in section 2.6 below).

Where voluntary and indicative responses are either not available or are ineffective, compulsory transparency obligations may be considered. These can be assessed, as with most regulatory interventions, against the regulator's ordinary set of regulatory principles. In many cases, transparency obligations are likely to be a proportionate response to concerns regarding traffic management: it is light-handed approach which leaves room for market-based mechanisms, is consistent with competitive market outcomes, and is unlikely to be overly onerous on suppliers.

2.3.2 Switching costs

For competition to affect the traffic management practices used by ISPs, consumers need to able to act on their experiences and information by switching provider. If there are two ISPs, identical except for their traffic management techniques, in a workably competitive market consumers should be able to switch to the more desirable ISP without undue costs or other barriers. The major obstacle to them doing so, other than inertia, is the widespread use of longer term contracts; up to 2 years.

Addressing switching costs is unlikely to be as straightforward as information transparency. Switching costs (and long-term contracts in particular) are not uniformly harmful. There are a number of reasonable justifications for their use. In many cases, they allow the cost recovery of financial and equipment incentives offered to the customers, such as handset subsidies (for mobile), modem or router subsidies (for fixed), or discounted rates. All of these incentives can promote competition.

Forcing a reduction in switching costs would risk diminishing the use of these incentives, and create a reduction in competition that would need to be assessed against the forecast improvements to competition (and to net neutrality) resulting from lower switching costs.

An alternative would be to ensure that switching costs are made clear to consumers; the principles for doing so are similar to the way traffic management information is disclosed, as discussed above. If warranted, a more interventionist response would be to require that fees for early termination of a fixed term contract be cost-reflective.

2.4 Quality of service assurances

There is a residual concern that if prioritization by ISPs becomes widespread, then the un-prioritized traffic will be so degraded that the CAPs that do not participate in prioritization will suffer competitively. This is the "dirt track" argument referred to in section 1.2.4 above. This gives rise to the question of whether to introduce measures that ensure a certain base level of quality of service. Or there may be a more general need for these measures where degradation, hindering or slowing down warrants the introduction of a minimum quality of service requirement.

In the European environment, Article 22(3) of the Universal Service Directive introduces a power for regulators to set minimum Quality of Service (QoS) requirements "[i]n order to prevent the degradation of service and the hindering or slowing down of traffic over networks".

BEREC has recently issued draft guidelines[17] for European regulators in determining what is a reasonable or unreasonable practice by an ISP, and whether an NRA should intervene by imposing minimum QoS requirements.

2.5 No blocking or other discriminatory practices

The active reformers have tended to go beyond tentative refinement of the regulatory regime to introduce specific net neutrality restrictions. The restrictions in particular control:

- blocking of lawful content, applications, services or (on occasion) non-harmful devices (e.g., USA FCC rules); and
- other discriminatory practices, which may be unreasonable or, while not outright blocking, render lawful content, applications or services effectively inaccessible or unusable (e.g., USA FCC rules, Chile, Singapore).

Usually these restrictions on blocking and other discriminatory practices are subject to reasonable network management measures.

The restriction on blocking of lawful content, applications and services may be seen as relatively uncontroversial, particularly when reasonable network management measures may apply. Although not a common practice around the world, blocking in these cases would be seen as concerning, particularly if conducted by an ISP with market power in the retail broadband market.

The more difficult issues arise under the restriction on "other discriminatory practices" and, in particular, whether this permits prioritization or access-tiering. Governments and regulators in active reformer countries have addressed this issue in various ways, mainly by seeking to carve out practices that would otherwise be caught by the general restriction on other discriminatory practices, but which are likely to be legitimate. For example:

- In Chile, regulations have been introduced to allow ISPs to introduce tiered pricing and speeds for Internet access;
- In Singapore, ISPs and telecommunications network operators are allowed to offer niche or differentiated Internet service offerings, provided that they meet transparency, QoS and competition requirements; and
- In the Netherlands, operators may offer a range of mobile data tariffs with different download speeds and levels of service, but they cannot tie specific rates to the use of specific free Internet services.

In relation to the suite of traffic management techniques, actions such as degradation, throttling, prioritization and access-tiering may walk a thin line between "unreasonable discrimination" and "reasonable network management". As discussed earlier, it can be difficult to distinguish between the two.

2.6 Approaches in five leading jurisdictions

This section briefly reviews the approaches and perspectives on traffic management from five leading jurisdictions. The jurisdictional review reveals that there is no one, universal, approach to regulating net neutrality. A more complete international summary of regulatory approaches to net neutrality can be found in the Appendix. Both developed and developing countries have been included in this review.

The United States

The United States is, in many respects, the home of the net neutrality debate. The arguments are louder, the lobbying more intense and the attempted legislative interventions more frequent. Yet although the Internet is a global phenomenon, the particular characteristics of the US market set it somewhat apart from other countries.

In the United States, the standard justification for imposing net neutrality remedies is *Comcast v the Federal Communications Commission* [18] and alleged blocking of certain services using the BitTorrent protocol. The FCC intervened in this instance to rule that Comcast was not entitled to throttle to the extent that it had been. Highlighting the uncertainty as to what constitutes "reasonable" traffic management, the FCC held that:

Although Comcast asserts that its conduct is necessary to ease network congestion, we conclude that the company's discriminatory and arbitrary practice unduly squelches the dynamic benefits of an open and accessible Internet and does not constitute reasonable network management.

However, the order was later vacated with the United States Court of Appeals upholding Comcast's appeal. The Court held that the FCC had acted outside its purported statutory authority under the Communications Act 1934. While the FCC acknowledged that nothing in the Act expressly empowered it to regulate an ISP's network management practices, it had sought to rely on various ancillary powers. The Court rejected all of the FCC's claimed authorities.

Since this case was decided, the FCC has persisted in its efforts to establish a more direct source of control in the form of net neutrality rules. In December 2010, it issued an open access notice which is based on three fundamental principles:

- **Transparency**. Fixed and mobile broadband providers must disclose the network-management practices, performance characteristics and terms and conditions of their broadband services;
- **No blocking**. Fixed broadband providers may not block lawful content, applications, services, or non-harmful devices. Mobile-broadband providers may not block lawful websites or block applications that compete with their voice or video telephony services; and
- **No unreasonable discrimination**. Fixed broadband providers may not unreasonably discriminate in transmitting lawful network traffic.

Both the "no blocking" and "no unreasonable discrimination" principles are expressly subject to a provider's ability to undertake "reasonable network management" as defined:

> *A network management practice is reasonable if it is appropriate and tailored to achieving a legitimate network management purpose, taking into account the particular network architecture and technology of the broadband Internet access service.*

These regulations remain highly controversial and are being challenged in federal court. As of writing, a decision has not been released.

European Commission

In Europe, the debate really started in 2009 when the European Commission (EC) issued its initial support for the net neutrality principle in a communication and then secured some basis for these principles in the amended directives issued as part of the new framework (see below). However, the number of actual interventions has been small, relying instead on general principles of competition law and the perceived level of competition available via existing regulatory protections or competitive network provision or both.

The EC, via the amended Universal Services Directive[19], introduced some measures aimed at promoting net neutrality when it mandated that national regulatory authorities should:

- be able to set minimum quality levels for network-transmission services (Article 22(3), *Universal Service Directive*);

- allow consumers to be able to switch between ISPs quickly and without unnecessary penalties (Article 30, *Universal Service Directive*); and

- ensure transparency in relation to ISPs' utilization of any traffic-shaping measures in their contracts with consumers (Article 21(3)(d), *Universal Service Directive*).

In 2010, BEREC conducted a review which did find evidence of particular discriminatory behaviors. More specifically, BEREC found that blocking of VoIP in mobile networks occurred in Austria, Croatia, Germany, Italy, the Netherlands, Portugal, Romania and Switzerland. Incidents of throttling or blocking of Internet traffic (e.g., of certain websites, the entire broadband connection, P2P file sharing or video streaming) occurred in France, Greece, Hungary, Lithuania, Poland and the United Kingdom. With respect to blocking of VoIP in mobile networks, some operators in some countries allowed usage of such VoIP services[20] for an extra charge.

BEREC has recently set out a work program covering different aspects relevant to net neutrality. They are based on different legal foundations, cover various market developments, and differ in their focus on legal, technical or economic analysis. BEREC has been consulting on[21]:

- Guidelines on transparency in the scope of net neutrality;

- Framework and Guidelines for quality of service in the scope of net neutrality, which assesses "degradation of service" and the conditions and ways to use the new Article 22(3) of the Universal Service Directive, i.e. how to intervene when deemed necessary;

- Differentiation practices and related competition issues in the context of net neutrality, which is an economic analysis about which practices may cause harm to end-users, and under which conditions; and

- NGN IP interconnection and net neutrality, which is an overview of IP interconnection markets and economic relationships between operators assessing the regulation with regard to IP interconnection in the context of net neutrality.

United Kingdom

In the UK, the main legislative intervention occurred in the amendment to the Communications Act 2003 and the Wireless Telegraphy Act 2006, which empowered Ofcom to undertake particular actions should it deem it necessary by way of its licensing powers.

These include the ability of Ofcom to impose minimum requirements in relation to the quality of public electronic communications networks to "prevent the degradation of service and the hindering or slowing down of traffic over networks" (the so called quality of service Condition).[22] No such condition has been issued to date.

Ofcom did, however, take steps to enhance transparency and, in May 2011, amended the General Conditions of Entitlement[23] to ensure that there is adequate transparency around the traffic management methods employed by ISPs and mobile operators.

In particular ISPs and mobile operators must provide:

(d) details of the minimum service quality levels offered, namely the time for initial connection and any other quality of service parameters as directed by Ofcom;

(e) information on any procedures put in place by the undertaking to measure and shape traffic so as to avoid filling or overfilling a network link, and information on how those procedures could impact on service quality.

And, finally, given the concern that users could not exercise their ability to change providers as a result of any degradation or blocking, there is a new General Condition 9.3 that requires that communications providers do not include conditions or procedures for contract termination that act as a disincentive for end-users to change providers. However, there are still options under EC law and UK law for period contracts, in particular for ISP services, IPTV and mobile phone contracts to amortize the cost of service provision and particularly the hardware.

Ofcom have undertaken consultations and reviews of the marketplace and found, in late 2011, that the use of market power and discrimination in traffic management to the benefit of an operator's retail arm is the main harm. They found that existing regulation and market structures resulting from those interventions provided substantial protections against discriminatory practices. Ofcom chose not to impose far reaching restrictions on traffic management practices. It also found that there was no need to impose a minimum quality of service at that time and would use existing tools including the competition rules.[24]

In response, many of the UK ISPs signed up to a voluntary code of practice which would require enhanced information for customers on their traffic management practices.[25] The voluntary code has three main components:

- an explicit commitment to provide more information to consumers about what practices are used in networks;
- an agreed set of good practice principles that will inform how ISPs communicate that information to consumers; and
- a commitment by each signatory to publishing a consistent Key Facts Indicator table, summarizing the traffic management practices it uses for each broadband product currently marketed.

The most recent flurry of interest over net neutrality in the UK came as a result of the formal launch by BT Wholesale of its wholesale content connect service (a CDN network service). This effectively gave ISPs access to a mechanism for prioritizing traffic via a new CDN service which caches content nearer to the user and so improves resilience and quality. Opinions differ starkly as to whether this flies in the face of net neutrality principles or is an economic reality which will substantially enhance the quality of the Internet.

Chile

After a four year process, Chile's General Telecommunications Law was amended in July 2010, with the implementation regulation published in September 2011. The new law forces ISPs to "ensure access to all types of content, services or applications available on the network and offer a service that does not distinguish content, applications or services, based on the source of it or their property". The law also allows ISPs to offer tiered pricing and service speeds to end users, with the intent being to facilitate a move away from flat fee pricing.

The Chilean law was brought about after a concerted lobbying effort by the pro-neutrality group Neutralidad SI ("Neutrality Yes!"). Although there does not appear to be a single catalyst for the decision to impose net neutrality, Neutralidad Si claimed that broadband operators were persistently restricting peer-to-peer traffic on their networks.

Felipe Morandé, Minister of Transportation and Telecommunications, welcomed the amendments, saying:

> *It is a concrete step toward having greater transparency in the broadband market, stimulating competition for quality of service, which is the pillar of our public policy in telecommunications. [The law] places our country at the forefront in the world in terms of net neutrality. It shows that there is the political will in Chile to modernize the regulation of telecommunications and empower consumers.*[26]

The Netherlands

In the Netherlands, legislation was recently passed on 8 May 2012 that prohibits telephone operators from blocking or charging consumers extra for using Internet-based communications services like Skype or WhatsApp, a popular free SMS service. Internet providers will also be prohibited from making prices for their Internet services dependent on the services that are used by a customer. Operators may still offer a range of mobile data tariffs with different download speeds and levels of service, but they cannot tie specific rates to the use of specific free Internet services.

The law derives from attempts by KPN (the incumbent operator) to charge users for access to Skype and WhatsApp. This was challenged on both privacy and net neutrality grounds. Particular criticism was aimed at the public disclosure by KPN executives that it was aware of the huge take up of free SMS app services based on extensive use of DPI techniques. OPTA, the telecoms regulator, may impose fines of up to 10% of sales for breaches of the new rules.

The rules do not, however, prevent the setting of tariffs based on data usage or specific quality of service provisions (indeed reports in July 2012 note that KPN has introduced new data mobile tariffs at higher rates than previously). The rules apply to all ISPs.

2.7 Other issues to consider during policy formulation

2.7.1 Human rights and the right to access information

In some debates, there can be a human rights element to net neutrality. This is particularly evident in respect of government attempts to block certain web sites or telecommunications services. This blocking may be routine or on an ad hoc basis. Ad hoc blocking of Twitter and SMS was reported in multiple countries during the Arab Spring uprisings for example. This type of blocking, by operators, mandated by government, can be distinguished from blocking undertaken at a commercial level and is not discussed further in this chapter.

2.7.2 Consumer privacy and freedom of communication concerns

An often overlooked issue in the net neutrality debate is the potential privacy concerns that may arise when an Internet users' personal information is managed as it passes over a network. In particular, the use of DPI seems to generate *prima facie* privacy concerns, as data about a users' behavior on the Internet (which will often include sensitive data) is monitored and used for various purposes, such as traffic management or advertising.[27] Privacy and freedom of communication are issues that will only become more pertinent over time as DPI technologies improve, which means they will need to be considered during the policy development process[28].

3 Industry response

In many ways, the net neutrality debate has been led by the major players in the telecommunications industry themselves. Fixed-line and mobile operators facing increasing capital investment costs sought to achieve more equitable business and revenue sharing models. In turn, CAPs have also responded by taking measures to protect their own interests, such as reducing reliance on public networks by using Content Delivery Networks (CDNs) or by having their own networks. The following section will seek to breakdown the interests of the key market participants, as well as outlining some of the potential industry-based solutions that have been discussed to date.

3.1 A tailored application of net neutrality principles

In order to develop appropriate policies to deal with net neutrality issues, it is important to understand the varying positions of the key players in the debate. Some countries, such as the United States, have distinguished between these key groups (i.e., between fixed and wireless networks) in their responses to net neutrality concerns.

3.1.1 Fixed and wireless networks

To date, fixed-line operators have done a relatively good job of increasing average revenues per line from their traditional, mainly copper-based networks, which has helped to offset the increasing costs of investment in new high speed networks and declines in revenue caused by applications such as VoIP. However, the industry is coming to a crossroads and the obstacles associated with the strict implementation of net neutrality principles are beginning to take shape. The primary issue facing fixed-line operators will be finding an appropriate and equitable means of funding the increased investment in new high speed broadband networks to meet the ever-growing demand for digital content.

However, network neutrality seems to be having a more immediate effect on the mobile industry. Increasing demand for capacity caused by new data-intensive applications combined with a shortage in spectrum has put mobile providers under pressure to make the investments that are necessary for growth. The outlook for the mobile industry suggests that wireless networks will continually need to be upgraded in order to keep up with capacity. In addition, applications like Skype or WhatsApp that offer rival services also present a considerable challenge to mobile players, because VoIP and IP-based messaging applications are now cannibalizing their traditional revenue streams.[29]

3.1.2 Content Delivery Networks and private infrastructure

A CDN is essentially a system of servers that are deployed at the edge or within a terminating ISP's network to facilitate an improved distribution of content and application services. CDNs do not interfere with the ISP's network layer and they do not provide connectivity, but instead they operate on top of the network layer. By storing content closer to end users, CDNs help to reduce latency and enhance service quality, which results in faster download speeds and response times for users. Furthermore, by storing content closer to customers, this content only needs to be delivered once from the CAP to the CDN's caching server, which reduces peering volumes and transit costs.[30]

Most major CAPs have started building their own Internet traffic infrastructure or using the dedicated CDNs of companies to ensure that their data-intensive services and applications are not constrained by delays or congestion in the public network. Although the investment in CDNs and private infrastructure are added costs on CAPs' traditional business models, by-passing the backbone of the public Internet allows CAPs to ensure that the immense volume of traffic that they generate reaches their customers at optimal speeds. This ultimately improves QoS and ensures greater customer uptake, which has made it a worthwhile investment for many larger content providers, particularly for those that have the scale to justify the initial costs of investment.

In many ways, the use of CDNs allows larger CAPs to manage their exposure to restrictive traffic management practices, which supports the principle of net neutrality. However, some have argued that this situation merely serves to put a different kind of strain on the principles of net neutrality. This is because the smaller CAPs, who cannot afford to invest in their own infrastructure or CDNs, will typically be unable to match the performance of the larger CAPs. Over time, this could serve as a barrier to entry and a limiting factor on innovation. Whether this disparity represents discrimination or simply a competitive disadvantage is open to debate.[31] It does mean that regulators cannot simply rely on CAPs to invest in CDNs to avoid restrictive traffic management practices because this may not be an option for smaller CAPs.

Figure 4 provides an example of Amazon's global data center and "edge" locations, which have been set up to improve the performance and delivery of Amazon's online services.

Figure 4: Amazon's global CDN and private infrastructure network

Source: Amazon Web Services online (http://aws.amazon.com/about-aws/globalinfrastructure/)

3.1.3 Accounting for the rest: smaller providers and consumers

Smaller CAPs without a CDN rely on the "public Internet" to reach their consumers. These providers face growing threats on two fronts.

On the one hand, their reliance on the public Internet means that traffic management will more significantly affect smaller CAPs whose content may be manipulated or indirectly controlled by an ISP. Content travelling over the public network is exposed to an ISP's traffic management practices. Similarly, as discussed in the previous section, the smaller providers will also continue to be at a competitive disadvantage in comparison to the larger CAPs that are able to offer services at a higher quality by transferring their data outside of the backbone of the public Internet. The risk is a growing barrier to entry for smaller and start-up CAPs.

Net neutrality advocates have argued that regulator involvement will be particularly necessary to ensure the continued existence of the smaller CAPs. To date, consumers have benefitted greatly from the innovation and product diversity that these smaller start-up and niche players provide, so it will be crucial to ensure the right conditions are in place to allow for their continued existence. Expecting CAPs to invest in costly CDNs may not be enough, which means some level of regulator intervention may be required to ensure that smaller CAPs are not disrupted by discriminatory behavior that limits their ability to efficiently distribute their services over the public Internet. For example, minimum QoS obligations could be mandated, which would help to ensure a basic level of competition across public networks.

3.2 Finding industry-based solutions

3.2.1 Self-regulation and co-regulatory models

Some industry players have called for government policy-makers to leave markets to regulate themselves. They argue that a body of technical experts from industry is in the best position to find solutions to the shared issues being faced by both network operators and content providers. Proponents of self-regulation argue that regulator

involvement risks over-regulation (and the added costs associated with regulatory compliance) and can bog down the problem-solving process with political agendas. The Broadband Internet Technical Advisory Group (BITAG) is an example of a body of technical experts that have been brought together to seek industry-based solutions to the net neutrality issue in the United States[32]. A body performing a similar role at the international level is the World Wide Web Consortium (W3C), which is a non-governmental body with extensive private membership and a full time staff that contributes to the regulation of the internet.[33]

Of course, there are a number of problems with relying on self-regulation. For one, self-regulation relies on voluntary compliance instead of punitive or exemplary sanctions to enforce conformity. There is also the question of who develops the industry code of conduct or regulation; the fear is that the larger market players are allowed to dominate the process to the detriment of smaller participants, particularly small CAPs.

A compromise may be to institute co-regulation. A co-regulatory scheme combines elements of self-regulation as well as of traditional regulation to form a new and self-contained regulatory scheme. However, the difficulties with finding the right balance between self- and public- regulation can make this approach challenging, and the likelihood of larger players dominating the process would continue to be a fear as smaller ISPs and CAPs may not have the resources necessary to effectively contribute.

3.2.2 Partnering: opportunities for collaboration between operators and CAPs

ISPs have tended to view over-the-top (OTT) applications and services such as VoIP as a threat to the traditional telecom value chain. It has been estimated that, in North America alone, traditional telco operators, both mobile and fixed, lost approximately US$30 billion of revenue between 2005 and 2010 to OTT applications that substitute for existing revenue streams.[34] However, in recent years, there has been a gradual realization across the industry that working in isolation only serves to harm all players; the market is converging and network operators and CAPs are being forced to adapt to prevent further losses of revenue and market share. The focus is now shifting towards the potential opportunities for collaboration that exist between ISPs and CAPs.

Mobile and fixed-line operators can use partnerships with CAPs to establish themselves as innovators and gain market share through cost-efficient customer acquisition. These partnerships would also provide opportunities for ISPs to increase revenues by reclaiming their footprint in the value chain. Greater collaboration with ISPs could also increase a CAP's end-user exposure by allowing it to gain access to an operator's user base and high quality network services. Partnerships would also present a chance to monetize the existing user base.[35]

4 Net neutrality and the International Telecommunications Regulations

4.1 Internet governance and the ITRs

The International Telecommunication Union (ITU) currently plays an important role in promoting the international interoperability of traditional telecommunications systems. The International Telecommunications Regulations (ITRs) are an international treaty governing the provision and operation of public telecommunications services, as well as the underlying transport mechanisms used to provide them. The regulations provide telecommunications administrations and operators with a broad framework to guide them in the provision of international telecommunications services. They establish general principles relating to the provision and operation of international telecommunication. They are designed to facilitate global interconnection and interoperability of telecommunication infrastructure, underpin the harmonious development and efficient operation of technical facilities, and promote the efficiency and availability of international telecommunication services. However, as an influential international body, the ITU's stance on net neutrality will set important benchmarks to guide national regulators.

The current version of the ITRs was adopted in 1988 in Melbourne, Australia, by the World Administrative Telegraph and Telephone Conference (WATTC), so the current regulatory structure is based largely on voice

telecommunications. The Internet was still in its infancy the last time the ITRs were updated; however, the Internet now forms an important component of the ITU's broader telecommunications mandate. For this reason, a number of proposals have been put forward to update the ITRs to take into account the modern prevalence of data communications. In this context, the ITRs will be revised by the World Conference on International Telecommunications (WCIT12) to be held in December 2012 in Dubai (UAE). The main objectives of the WCIT12 are to adapt the ITRs and facilitate the achievement of the following goals: ensuring the free flow of information, the development of broadband networks and services, continuing investment in networks, services and applications as well as continuing innovation.

4.2 Update of the ITRs

A number of suggestions have been put forward to update the ITRs. Some of the proposals presented to the Council Working Group to prepare the 2012 World Conference on International Telecommunications concern network neutrality. [36]

For one, ITU Member States will need to determine to what extent the ITRs would affect national policies regarding regulation of traffic management and QoS prioritization. For example, some proposals would provide that Member States agree to allow differentiated traffic management, which is basically saying that Member States would agree not to impose strict network neutrality regulations. As discussed earlier, traffic management is a common practice among telecom operators. While QoS prioritization would lead to improved performance and could result in an indirect form of revenue sharing between CAPs and network operators, these benefits will need to be weighed against the added costs and complexity of complying with new QoS obligations. [37]

Ultimately, the key will be taking a broader view on the key net neutrality issues facing national regulators and extending them to the international level. In an effort to situate the principles of net neutrality within the broader ITRs framework, the impending update of the ITRs will need to strike an appropriate balance between public access to international telecommunications services, while still maintaining the ability to prioritize critical services and to ensure adequate service quality.

5 *The future: what's coming next?*

5.1 Is net neutrality going to remain an issue moving forward?

Net neutrality is an issue that is only likely to grow in importance as new data-intensive applications and services put an increasing strain on telecommunications networks. It is important to remain forward looking to try to understand how these issues will likely play out in the future.

This means that the debate surrounding the extent to which net neutrality should be regulated will only intensify. This section assesses the arguments for and against the regulation of net neutrality in an effort to tease out what future business models will look like for telecommunications network providers.

5.2 Arguments against net neutrality protections

Those who say there is no problem, or that wide-ranging net neutrality protections are not required, point to the following factors:

5.2.1 The countervailing power of CAPs

The countervailing market power of the CAPs, particularly the major players who are the strongest advocates for net neutrality concepts. If a particular ISP was to threaten to charge a Google or Amazon, they could threaten to withdraw the service from that ISP. The loss of this service would have a substantial impact on the ISP and it would

face a material risk of client loss to other ISPs that did have access to these services. While the CAP would lose access to the ISP's subscriber base, the largest CAPs are now so big and have such a diverse set of users internationally that such a move would have little impact on their total revenue. This argument is strongest when there is a vibrantly competitive retail broadband market.

5.2.2 The importance of traffic management

The general acceptance that traffic management is essential to protect the consumer experience, especially in times of potential extreme network congestion.

5.2.3 Free market solutions already in place

The market now deals with the issue by virtue of a range of new mechanisms, including:

- tiered pricing structures, so that data hungry users are charged additional sums for the data used and utilization and price are more closely aligned; and
- the use of CDNs by CAPs to reduce their access costs and improve the quality of service for their customers.

5.2.4 Charging CAPs would not be sufficient

If charging CAPs was to be widespread, it would be unlikely to provide sufficient sums to drive network upgrades given the scale of the revenues of these providers versus the cost of the network upgrades required. The giant values of many of these CAPs in stock market terms generally does not equate to a material revenue stream or huge profitability, with the exception of one or two of the largest players, whose revenues tend to derive not from content delivery but rather advertising revenues. A good example of this was the recent public offering of Facebook, which valued the company at approximately US$104 billion despite the fact that the company's annual revenue stream was only $US 1 billion per year and its subscriber base had basically peaked at approximately 900 million users.[38]

5.2.5 Net neutrality rules may actually reduce ability to offer tiered services to third parties

An over-application of net neutrality rules will actually reduce the ability of providers to offer properly tiered services to third parties. For example, net neutrality rules should not prevent ISPs from providing higher QoS to business customers (or home workers). However, where the incumbent has market power, then they will need to be applied in such a way that prevents incumbents from acting anti-competitively and discriminating in favor of their own content and applications business in the provision of such services. Therefore, the issue is actually about the effectiveness of any over-arching telecommunications regulatory regime and its ability to effectively target discriminatory conduct, drive competition in retail markets where there is wholesale market power and do so in a timely and effective manner.

5.2.6 Focus should be on other more pressing issues

There are other much greater issues at play, such as incentivizing network investment generally in the face of questionable retail appetite for higher prices for higher speeds or data usage and the perception of "free" services being available. Another issue is the need for effective access regulation more generally, which could be used to improve competitive access to retail and wholesale services and would reduce the need for specific net neutrality type protections. The net neutrality argument in the US has achieved greater resonance due to the view that the access regulatory mechanisms been seen by some as failing to deliver adequate retail or wholesale competition for services, meaning that additional protections for consumers are required.

5.2.7 Competition in the retail space

Retail competition is being bolstered by a range of measures:

- ongoing access regulation to secure the greatest level of retail competition, including functional separation and effective enforcement of existing access remedies and competition rules for non-discrimination and equivalence of inputs/outputs rules;[39]
- increased transparency by operators as to their practices on blocking and network management;
- easier switching mechanisms between ISPs; and
- ongoing monitoring of practices in this space by regulators.

5.3 Arguments in favor of net neutrality protections

Those that predict a problem if specific additional protections to secure net neutrality are not implemented argue:

5.3.1 The insufficiency of competition rules

The inability of competition rules to deal with complex issues of network security, data prioritization and other complex network dialogues in a timely manner. The issue of proof and difficulty in securing injunctions to prevent particular behaviors, as well as the length and cost of court processes in many countries, require specific regulatory protections over and above general competition law.[40]

5.3.2 Lack of competition at the retail level

The lack of competition at the retail level in certain jurisdictions can give power to incumbents, as they would be less likely to lose customers in the face of degradation of traffic/access to certain sites. This is often argued to be the result of flawed access regulation in the particular country and may well require additional intervention at the wholesale level more generally, or functional or structural solutions, to deal with access bottlenecks. Similarly, it may be that it is a problem in specific parts of a member state's market as NGA networks are rolled out on a regional/piecemeal basis and regulatory remedies progressively apply in a sub-national context.

5.3.3 Lack of regulatory protections against network degradation

The lack of regulatory protections against network degradation in mobile networks, with the vast majority of access remedies focused on fixed incumbent providers. The proposed US regulations, for example, place much stricter obligations on fixed operators than wireless operators and the EC access rules are not presently applied to mobile carriers. This is coupled with the move to longer term mobile contracts (often up to 2 years), which could potentially reduce the ability of customers to switch network in the event of blocking or degradation of certain services by mobile players, including of VoIP services.

5.3.4 Inability of smaller CAPs to compete

The ability of smaller and start-up CAPs to compete with the more established CAPs may be affected if they are unable to secure access to specific ISPs or afford access-tiering charges. This would be particularly concerning where an ISP with SMP was to reach an exclusive arrangement with an established CAP or where smaller CAPs were unable to secure affordable access to increasingly-prevalent CDNs. The increasing use of CDNs could increase the risk of the smaller CAPs struggling to secure enhanced access to their services in the face of prioritization of the

more established players. These potential barriers to entry may deter new start-ups from joining the market, which threatens to hinder innovation and diversity in the long run.

5.3.5 Unfair advantage for IPTV services

As IPTV develops and is promoted by incumbent telecommunications providers as a means of driving demand for higher speed networks (and therefore premium service charges), there may be more pressure on these players to prioritize their own IPTV services over those from third parties. The growing movement towards bundled packages that could include a range of related services (e.g. IPTV, telephony, internet, etc.) at cheaper prices gives telecommunications providers an incentive to extend, and discriminate in favor of, their own offerings down the supply chain.

5.4 Future regulatory and business models

5.4.1 Exploring new regulatory models

There is ongoing debate on the appropriate regulatory model for NGA access. Given the underpinning driver for the intensity of the net neutrality debate was the need for investment and upgrades to the network in both access and backhaul, it is hard to see the two regulatory issues not coming into conflict soon. This is particularly true if the widest interpretation of net neutrality is applied and there is pressure to prevent network owners charging extra sums for higher bandwidth or better quality of services. This flexibility will be key to securing economic roll out of NGA services and justifying the investments needed in the network. The rules will need to allow pricing models to recognize enhanced speed and services. The disparaging notion of a "two speed Internet" will need to be replaced by a more nuanced realization of the consumer desire for differential speeds and qualities based on their needs.

Unquestionably, transparency on the services being delivered and how this is realized is relevant and will assist customers to determine the services they wish to secure. Indeed this is the focus of much of the debate at present in Europe and the UK, alongside securing switching and general competitive provision of retail services. For example, the European Commission's NGA Recommendation on access to NGA[41] cites the need for effective access remedies to NGA where there is market power.

Net neutrality alone is not a sufficient reason to justify increasing capacity through investment in next-generation fixed and wireless networks. But to the extent that this investment occurs for broader objectives, then the regulatory model for these developments should at least consider net neutrality concerns and – if necessary – define and restrict the use of unreasonable traffic management measures. Where governments incentivize investment through regulatory concession, governments should be reluctant to make concessions that may unduly threaten net neutrality.

NGA investment and the accompanying regulation are being dealt with in various ways. In certain jurisdictions, the solution has been to create a completely separate entity which will provide basic connectivity services to all comers and with no activity in the retail space itself. This is the case in Singapore, Australia and New Zealand. In the UK, a model of functional separation aims to do something similar by attempting to bolster non-discrimination rules by the creation of a network arm for BT which provides many of the services underpinning NGA on a non-discriminatory basis, but without full structural separation.

The approach that is ultimately taken within a jurisdiction will stem from a broader philosophical decision that will need to be made on the level of state participation in the market. If a more laissez-faire approach is taken, the government will seek to encourage operators to invest in their infrastructure by providing them with regulatory certainty that benefits from investing in new network infrastructure will be captured by those making the initial investments. For example, the United States has sought to encourage investments by relieving operators of the obligation to unbundle their networks.

On the other hand, a government may opt to play a more prominent role in the market in order to guide and promote innovation and investment. This is the approach that was recently taken in Australia and Singapore, where the state injected the capital necessary to update legacy networks when the incumbent operators were unable or unwilling to make the necessary investments themselves.

5.4.2 New revenue models in a converging environment

New business models are being suggested to deal with the investment required due to the growing data consumption and new more bandwidth-hungry content and applications provided by CAPs. These include prioritization for higher prices (including of an ISP's own services, like IPTV), charging CAPs for prioritization for delay-sensitive services and providing guaranteed network capacity for end users.

Under the current prevailing internet business model:

- ISPs charge end users for internet access. ISPs pay for transit from international operators, or they peer; and
- CAPs charge end users for their services, or provide it for free (normally supported by advertising). CAPs pay for hosting and connectivity from ISPs that provide this particular service.

Although not occurring on any widespread basis at the moment, ISPs could require that CAPs pay an ISP for prioritization – faster or higher quality service relating to the ISP's network. This isn't happening probably because ISPs and CAPs typically don't have any physical or contractual relationship – they interface with the myriad of internet intermediaries. However, the absence of this physical or contractual relationship may not prevent an ISP charging a CAP. The risk for the CAP is their services are degraded relative to other competing services and they are prepared to pay for that not to happen.

Internet access can be thought of as a type of platform or intermediary where two groups are involved – CAPs and end users, with ISPs providing the platform on which they interact. Two sided markets theory suggests that this type of charging by an ISP is not necessarily inefficient – depending on the relative elasticities of demand for CAPs and end users.

Large CAPs have significant power to demand reasonable commercial terms in this sort of negotiation. Smaller CAPs may be more vulnerable, but can be represented in negotiations by large hosting and connectivity providers that can have equivalent bargaining power. Also, it must be recognised that there is value to the ISP in CAPs providing a high quality service to end users, as that increases the value of the Internet access services ISPs provide.

6 Recommendations

6.1 Existing market structure and regulatory environment

Recommendation 1: ensure that there is effective competition in the retail broadband market generally and, if not, take steps to increase this effectiveness.

Recommendation 2: review existing telecommunications regulation and competition laws to determine whether the regulatory tools are already in place to adequately address the competition issues that tend to impact on the principle of net neutrality. In many cases anti-discrimination obligations will already be available, which can be used to prevent ISPs from favoring themselves against a rival CAP's content or application, and regulators should consider strengthening these obligations and their effectiveness.

6.2 Transparency

Recommendation 3: to promote competition in the retail broadband market, traffic management practices should be made public through clear and useful consumer information. This should be driven, initially, through voluntary guidelines and self-regulation backed up by consumer protection law. If this proves ineffective, binding information disclosure obligations may be necessary.

6.3 Switching

Recommendation 4: customers should be able to quickly and efficiently end their contract without high switching costs if they wish to change Internet providers. This ensures that customers are able to take action if they disagree with the terms of service in their contract with an ISP. The costs (and other barriers) to consumers switching ISPs should be considered, with a view to ensuring that switching costs are clear and fair. Early termination charges may be justifiable to recover any up-front costs or subsidies provided by the ISP, but these should also be transparent (and potentially be required to reflect cost-recovery).

6.4 Use of DPI

Recommendation 4: the growing use of DPI can create potential privacy concerns as operators are now able to view a users' personal information at a greater level of detail as it passes over a network. A minimum level of transparency should be required from ISPs so that a customer is aware of how their personal information is captured and used by the ISP.

6.5 QoS

Recommendation 6: regulators should possess the power, to be held in reserve, to impose minimum QoS requirements on Internet access services where over-prioritization degrades the "best efforts" Internet.

6.6 Net neutrality-specific regulation

Recommendation 7: if concerning traffic management practices remain despite the recommendations above, regulators should consider specific targeted regulatory remedies, including restrictions on blocking and unreasonable discriminatory behavior in traffic management.

7 Regulatory checklist: asking the right questions

7.1 Effective retail broadband competition

Is there effective competition in the retail broadband market generally or is the market controlled by a small number of powerful ISPs who are largely able to degrade traffic without the fear of losing customers?

If there is not effective competition in the retail broadband market generally, are there other steps that can be taken, consistent with international best practice, to improve the level of competition?

7.2 Traffic management

Are network management practices, such as blocking or throttling, prevalent and, if so, are they generally for legitimate (e.g. to alleviate congestion) or illegitimate (e.g. to discriminate against rivals) purposes?

Are smaller CAPs sufficiently able to compete? If not, is some level of state intervention required (e.g. regulate minimum QoS requirements to ensure reliable service)?

7.2 Existing regulation and competition law

Is the existing regulatory framework for telecommunications, including competition law, able to adequately address the more concerning forms of traffic management?

Would a self- or co- regulatory model be sufficient to address any net neutrality issues that currently exist?

7.3 Transparency

Are ISPs open and transparent with their customers about how they conduct their traffic management practices?

How easy is it for customers to switch service providers if they disagree with their ISP's traffic management practices?

Appendix: International summary[xlii]

Country	Summary	Legislation	Regulatory measures in place	Competition regime
Australia	Australia does not regulate the ability of service providers to discriminate between different types of network traffic. There are presently no net neutrality requirements, and it is common practice in Australia for service providers to offer "walled content" or impose download caps or throttling mechanisms.	None specifically applicable to net neutrality. The Competition and Consumer Act 2010 (CCA) provides for access regulation, as well as generic competition law.	None specifically applicable to net neutrality. Regulated services must be offered on set price and/or non-price terms. These include non-discrimination and equivalence requirements. NBN Co, the state-owned company that is building the nationwide FTTP, must give a "special access undertaking" that includes non-discrimination and equivalence.	The CCA is overseen by the Australian Competition and Consumer Commission (ACCC). The CCA contains both generic and sector-specific competition and access regimes that apply to the telecoms sector.
Brazil	The final text of a bill was recently presented to the Brazilian Congress. The bill places Internet access among relevant civil rights. The bill contains net neutrality protections, including a prohi-	The bill - officially named Marco Civil - begins with general principles for the regulation of the Internet, including "IV: to preserve and guarantee network neutrality".		

Country	Summary	Legislation	Regulatory measures in place	Competition regime
	bition of discrimination or degradation by ISPs.	ISPs must treat all data equally, and cannot discriminate or degrade services, except for limited technical reasons. Users have the right to non-suspension or degradation of the quality of contracted Internet connection. ISPs may not monitor, filter, analyze or monitor the content of data packets, except for technical management.		
Canada	The Canadian Radio-television and Telecommunication Commission (CRTC) requires CRTC approval if an ISP employs more restrictive Internet traffic management practices (ITMPs) for its wholesale services than for its retail services.	The Commission must grant prior approval pursuant to section 36 of the Telecommunications Act if an ITMP employed by an ISP would result in the carrier controlling the content or influencing the meaning or purpose of telecommunica-	The CRTC does not regulate retail Internet services or computer-to-computer VoIP services that reside solely on the Internet. However, the CRTC has put industry on notice that it may monitor ITMP upon consumer complaints.	The CRTC is responsible for sector-specific competition issues in the broadcasting and telecommunications industries. The Canadian Competition Bureau is responsible for overseeing the enforcement

Country	Summary	Legislation	Regulatory measures in place	Competition regime
	In order to enhance competitive neutrality, technical ITMPs (i.e., "shaping") of wholesale services must comply with the CRTC's ITMP framework and must not have a significant and disproportionate impact on secondary ISP traffic.	tions.		of competition laws more generally.
Chile	In July 2010, Chile became the first nation to put net neutrality principles into law. In a vote by the Chilean legislature, the law passed by a near unanimous vote. The new law forces ISPs to "ensure access to all types of content, services or applications available on the network and offer a service that does not distinguish content, applications or services, based on the source of it or their property".	The General Telecommunications Law was amended by Bulletin 4915. Under the amendments, no ISP can block, interfere with, discriminate, hinder, nor restrict the right of any Internet user to use, send, receive or offer any content, application, or legitimate service through the Internet, as well as any activity or legitimate use conducted through the Internet.	The regulation proposed by telecoms regulator Subtel in January was criticized by net neutrality supporters. The main sticking point was a clause of "previous disclosure," which appeared to allow ISPs to discriminate against certain content providing they stated their intentions in the terms and conditions of the contracts. The amended regulation published in the official gazette on March 18 2011 eliminated the controversial clause and	

Country	Summary	Legislation	Regulatory measures in place	Competition regime
			replaced it with clearer guidelines. The regulations allow ISPs to introduce tiered pricing and speeds for Internet access.	
Egypt	There are currently no limits on an ISP's freedom to control or prioritize the type or source of data that it delivers, unless otherwise specified in the provider's telecoms licence.	The telecoms and media sectors are governed by the Telecommunications Law No. 10 of 2003 (Telecoms Law).	There are no specific regulations or other policies in place to deal with net neutrality. However, specific net neutrality provisions may be included in the terms and conditions of an ISP's telecoms licence.	Telecoms services are regulated by the National Telecommunications Regulatory Authority (NTRA). Through the Telecoms Law, the NTRA is responsible for regulating competition within the telecoms and media sectors. Telcos will also be subject to general competition laws, which are regulated by the Egyptian Competition Authority.
European Commission[xliii]	In 2009, the European Commission issued its initial support for the net neutrality principle	There is no specifically applicable legislation.	The Commission, via the revised universal services	The Commission relies on general competition law principles (as well as existing

Country	Summary	Legislation	Regulatory measures in place	Competition regime
	in a communication and then incorporated these principles in the amended directives issued as part of the new framework. However, the number of actual interventions is low, relying instead on general principles of competition law and the perceived level of competition available via existing regulatory protections or competitive network provision or both.		directive, allows NRAs to: ▪ set minimum quality levels for network-transmission services; ▪ allow consumers to be able to switch between ISPs quickly and without unnecessary penalties; and ▪ ensure transparency in contracts in relation to traffic-shaping.	regulation) to protect against the main harm of market power being used to unfairly discriminate.
France	On 13 April 2011, the French Parliament released the 'Report of the Fact Finding Mission on Net and Network Neutrality' which put forward 9 proposals for addressing net neutrality. The proposals included enshrining net neutrality as a policy objective; amending Internet blocking obligations; regulating Internet universality	The legislative instruments that set out some minimal requirements related to net neutrality are the Postal and Electronic Communications Code (CPCE) and the Third Telecom Package.	Under the CPCE and the Third Telecom Package, various regulatory provisions exist that require service providers to block certain types of criminal conduct once the provider becomes aware of the conduct.	The Competition Authority is responsible for applying general competition laws. The ARCEP is the telecoms-specific regulator. The ARCEP brings matters before the Competition Authority when questions concerning anti-competitive practices arise.

Country	Summary	Legislation	Regulatory measures in place	Competition regime
	and quality; and ensuring viable financing of the Internet.			
Japan	The Ministry of Internal Affairs and Communications (MIAC) released a report regarding network neutrality in September 2007. The report identified two issues — fair allocation of network development costs and fair access to the network by telecommunications operators, including content providers. The report discussed whether telecommunications operators may engage in packet shaping (or traffic blocking) to ensure the network's service quality. ISPs may impose additional charges on heavy users and content distributors.	Under industry guidelines, packet shaping may violate the Telecommunications Business Law (TBL) but is permitted in exceptional situations, such as heavy user traffic or a specific application excessively occupying the network. The guideline also states that telecommunications operators should let users know of the possibility of packet shaping and how and when it would occur. The Law concerning Providers' Responsibility is applicable to providers of telecom services intended for the public.	The Net Neutrality Report was published in September 2007.	The competition law authority is the Fair Trade Commission, an independent administrative agency with the authority to prevent unfair trade or market dominance.

Country	Summary	Legislation	Regulatory measures in place	Competition regime
New Zealand	No specific provision for net neutrality, but ISPs are subject to general regulatory and competition obligations.	None specifically applicable to net neutrality. The Telecommunications Act 2001 sets out an access regime for certain telecommunications services. The Commerce Act 1986 is New Zealand's generic competition law legislation.	None specifically applicable to net neutrality. Regulated services must be offered on set price and/or non-price terms. These include non-discrimination and equivalence requirements. Fiber providers under the Government's FTTP initiative must give open access undertakings that include non-discrimination and equivalence. The Commerce Commission is currently undertaking a Demand Side Review, looking at possible impediments to the uptake of ultra-fast broadband. The terms of reference for this review include net neutrality.	Generally superseded by service-specific telecommunications regulation, but still available.
Republic of Korea	While legislation does not expressly address net neutrality and the KCC has not formally published its policy on the issue	There is no legislation specifically applicable to net neutrality.	The KCC has not published any policy in relation to net neutrality, although it has taken action	KCC is the Korean telecommunications regulatory authority.

Country	Summary	Legislation	Regulatory measures in place	Competition regime
	yet, there is a precedent in which a broadband carrier was sanctioned for blocking VOD service provided by another VOD service provider. The KCC found such blocking was a prohibited activity. The dispute was resolved by the VOD service provider's agreement to pay a network usage fee to the carrier.	The primary laws in this area are the Act on Framework of Telecommunication and the Telecommunication Business Act (TBA). The Radio Waves Act governs radio frequencies and the Broadcasting Act regulates the radio waves used in broadcasting.	under the TBA (see summary).	The KCC also makes specific regulations for the telecommunication and broadcasting industry. The Korea Fair Trade Commission (KTFC) is the competition authority. The Monopoly Regulation and Fair Trade Act (MRFTA) is the generic competition legislation.
Singapore	The Info-communications Development Authority (IDA) issued its decision on net neutrality in June 2011, following a consultation process. ISPs and network operators are prohibited from blocking legitimate Internet content. They cannot impose discriminatory practices, restrictions, charges or other measures	There is no legislation directly relevant to net neutrality.	ISPs and telecommunications network operators must comply with information transparency requirements and disclose to end-users their network management practices. Reasonable network management practices are allowed, subject to minimum QoS requirements and not render-	Under the IDA's decision, ISPs and network operators must comply with the competition and interconnection rules set out by the IDA in the Telecom Competition Code.

Country	Summary	Legislation	Regulatory measures in place	Competition regime
	which, while not outright locking, will render any legitimate Internet content effectively inaccessible or unusable.		ing legitimate content inaccessible or unusable. ISPs and telecommunications network operators are allowed to offer niche or differentiated Internet service offerings that meet transparency, QoS and competition requirements.	
South Africa	There are currently no limits on an ISP's freedom to control or prioritize the type or source of data that it delivers. Net neutrality is not regulated in South Africa at the moment.	The Electronic Communications and Transactions Act 2002 (ECTA) provides for the facilitation and regulation of electronic communications and transactions, including the broader development of a national Internet strategy. There are currently no general obligations on the service provider to monitor the data that it transmits or stores – ISPs are largely free to manage data flow as they deem	There are no specific regulations or other policies in place to deal with net neutrality.	The Competition Act 1998 is the generic competition legislation that deals with all economic activity in South Africa, including the telecoms sector. The Competition Commission oversees compliance with the Competition Act. Telecoms firms are also subject to sector-specific regulation from the Independent Communications Authority of South Africa (ICASA). There is overlapping

Country	Summary	Legislation	Regulatory measures in place	Competition regime
		appropriate.		jurisdiction between the regulators.
The Netherlands	Recent legislation was passed on 8 May 2012 that will prohibit mobile operators from blocking or charging consumers extra for using Internet-based communications services. Operators may still offer a range of mobile data tariffs with different download speeds and levels of service, but they cannot tie specific rates to the use of specific free Internet services.	The Netherlands is one of the few countries to address net neutrality concerns through legislation. The recent amendments were to the existing Telecommunications Act.		The Netherlands has decided to implement specific net neutrality provisions in legislation, as opposed to relying on general competition law.
United Kingdom	Ofcom have found that the use of market power and discrimination in traffic management to the benefit of one's retail arm is the main harm. Ofcom has not imposed strict restrictions on traffic manage-	The main legislative intervention occurred in the amendment to the Communications Act 2003 and the Wireless Telegraphy Act 2006, which empowered Ofcom to undertake particular actions	In May 2011, Ofcom amended the General Conditions of Entitlement to ensure that there is adequate transparency around the traffic-shaping methods employed by ISPs and mobile operators.	Ofcom is largely relying on existing regulation and market structure to protect against harm from the use of market power to discriminate in a non-neutral fashion.

Country	Summary	Legislation	Regulatory measures in place	Competition regime
	ment, but instead relies on existing regulation and market structures. In another light touch approach, they found that if ISPs failed to secure an efficient degree of transparency only then would Ofcom consider introducing "more prescriptive policy options". In response, most UK ISPs signed up to a voluntary code of practice which required enhanced information for customers.	should it deem it necessary by way of its licensing powers. These include the ability of Ofcom to impose minimum requirements in relation to quality of service. No such condition has been issued to date.	In particular, ISPs and mobile operators must provide details of the minimum QoS that is offered and information on procedures put in place by the undertaking to measure and shape traffic. Finally, given the concern that users could not exercise their ability to change providers as a result of any degradation or blocking there is a new General Condition 9.3 that requires that communications providers do not include conditions or procedures for contract termination that act as a disincentive for end-users to change communications provider.	
United States	The FCC has adopted targeted regulations, including net neutrality requirements, which apply to retail broadband	There have been a number of attempts to legislate net neutrality principles, but these have all been strongly opposed and none have	The FCC generally does not regulate the Internet or Internet-related services. Under the federal statutory framework, services are either regulated	The FCC regulates the competitive aspect of the telecommunications marketplace concurrently with the United States Department of

Country	Summary	Legislation	Regulatory measures in place	Competition regime
	access services. The FCC's rules prohibit fixed broadband service providers from blocking lawful content, applications, services or non-harmful devices. A narrower mandate applies to mobile broadband providers. The no-blocking rule is qualified by reasonable network management practices. The FCC's rules also forbid fixed broadband service providers from unreasonably discriminating in transmitting lawful traffic over a consumer broadband service. These regulations remain highly controversial and are being challenged in federal court. As of writing, a decision has not been released.	passed.	telecommunications services or unregulated information services, although the FCC has the authority to adopt regulations that apply to information services where necessary to achieve a specific statutory goal relating to telecommunications services. The FCC has deemed most broadband services to be unregulated information services. Generalized "pay for priority" practices would be unlikely to satisfy the unreasonable discrimination standard, but the rules allow tiered pricing based on bandwidth usage or speed.	Justice and the Federal Trade Commission, which holds general jurisdiction over antitrust and competition issues.

[1] Malcolm Webb thanks Gordon Moir, Jordan Cox and Chris Taylor of Webb Henderson for their contributions to this paper.

[2] See BEREC, 'Response to the European Commission's Consultation on the Open Internet and Net Neutrality in Europe', BoR (10)42, September 2010, 2-3.

[3] See BEREC, Draft BEREC Guidelines on Net Neutrality and Transparency', BoR (11) 44, September 2010, 7.

[4] See European Union, 'Legal Analysis of a Single Market for an Information Society – Net Neutrality' *(*November 2009), 3.

[5] See BEREC, 'Response to the European Commission's Consultation on the Open Internet and Net Neutrality in Europe', BoR (10) 42, September 2010, 3.

[6] See IEEE, 'Network Traffic Management and the Evolving Internet (White Paper)' (2 November 2010), 4.

[7] See BEREC, A View of Traffic Management and Other Practices Resulting in Restrictions to the Open Internet in Europe, BoR (12)30, 29 May 2012, 10.

[8] See BEREC, Response to the European Commission's Consultation on the Open Internet and Net Neutrality in Europe BoR, (10)42, September 2010, 15.

[9] See BEREC, A View of Traffic Management and Other Practices Resulting in Restrictions to the Open Internet in Europe, BoR (12)30, 29 May 2012, 9.

[10] See BEREC, 'Differentiation Practices and related competition issues in the scope of Net Neutrality', BoR (12) 31, 29 May 2012, 49.

[11] See CRTC, ISP Traffic Management Technologies: The State of the Art, January 2009.

[12] Ibid.

[13] See Napatech, Scaling Policy Enforcement and Deep Packet Inspection (white paper), January 2011, 3.

[14] See CRTC, ISP Traffic Management Technologies: The State of the Art, January 2009.

[15] Berkman Center for Internet & Society, 'Next Generation Connectivity, A review of broadband Internet transitions and policy from around the world', http://cyber.law.harvard.edu/pubrelease/broadband/

[16] See Ofcom, 'Ofcom's approach to net neutrality', (24 November 2011), 13-14.

[17] http://berec.europa.eu/files/news/bor_12_32_guidelines.pdf.

[18] Comcast Corporation v Federal Communications Commission and United States of America, 600 3f.D 642.

[19] Directive 2002/22/EC (the 'Universal Services Directive'), http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32002L0022:en:NOT.

[20] Germany: 3 out of 4 mobile operators now allow VoIP, one of them without additional costs.

[21]http://berec.europa.eu/files/document_register/2012/8/BoR_%2812%29_34_Expl._paper_to_PC_on_NN_2012.05.29.pdf.

[22] See Directive 2009/136/EC of the European Union Parliament and of the Council of 25 November 2009, Art 22(3).

[23] See Ofcom, 'Consolidated Version of General Conditions as at 9 July 2012' available online at http://stakeholders.ofcom.org.uk/binaries/telecoms/ga/general-conditions.pdf.

[24] See Ofcom, 'Ofcom's approach to net neutrality' available online at http://stakeholders.ofcom.org.uk/binaries/consultations/net-neutrality/statement/statement.pdf.

[25] See http://www.broadbanduk.org/component/option,com_docman/task,doc_download/gid,1335/ See also BT's Broadband Usage Policy: http://bt.custhelp.com/app/answers/detail/a_id/10495/~/broadband-usage-policy.

[26] See 'Chile: A Leader in Net Neutrality Legislation' (accessed 18 July 2012) available online at: http://openmedia.ca/plan/international-comparisons/chile.

[27] Angela Daly, 'The Legality of Deep Packet Inspection' (June 2010), 8.

[28] For more information on the issue, see the ITU GSR12 Discussion Paper on "Safety and security in the cloud".

[29] See Scott Beardsley et al, 'Network Neutrality: An Opportunity to Create a Sustainable Business Model' in *The Global Information Technology Report 2012: Living in a Hyper Connected World*, 58.

[30] See BEREC, 'An Assessment of IP-Interconnection in the Context of Net Neutrality (Draft)' (29 May 2012), 14.

[31] See Scott Beardsley et al, 'Network Neutrality: An Opportunity to Create a Sustainable Business Model' in *The Global Information Technology Report 2012: Living in a Hyper Connected World*, 57 – 58.

[32] The BITAG Technical Working Group brings together experts from across the industry to research and formulate opinions and "best practices" on technical management issues that impact on internet management. Some of the stated roles of BITAG are to: (1) educate policy-makers on technical issues; (2) identify "best practices" and issue advisory opinions; and (3) provide technical guidance to affected industries and the public.

[33] See W3C homepage available online at: http://www.w3.org/ (accessed 11 September 2012).

[34] See Scott Beardsley et al, 'Network Neutrality: An Opportunity to Create a Sustainable Business Model' in *The Global Information Technology Report 2012: Living in a Hyper Connected World*, 59.

[35] See Thunstrom, B et al, 'Disruptive Threat or Innovative Opportunity? Scenarios for Mobile Voice OTT', 5.

[36] For more information, see www.itu.int/wcit.

[37] See Center for Democracy & Technology, 'ETNO Proposal Threatens to Impair Access to Open, Global Internet' (21 June 2012), 5-6.

[38] See BBC, 'Facebook Valued at $104bn as Share Price Unveiled', available online at: http://www.bbc.co.uk/news/business-18105608 (accessed 20 May 2012).

[39] See latest EC discussion paper on enforcing non-discrimination principles - http://ec.europa.eu/information_society/policy/ecomm/library/public_consult/non_discrimination/index_en.htm

[40] See European Commission, Progress Report on the Single European Electronic Communications Market 2009, SEC (2010)630, p 6.

[41] Commission Recommendation of 20 September 2010 on regulated access to Next Generation Access Networks, 2010/572/EU.

[xlii] Unless sourced separately, for most jurisdictions see Getting the Deal Through, 'Telecoms and Media: An Overview of Regulation in 46 Jurisdictions Worldwide' (2011 and 2012).

[xliii] Directive 2002/22/EC (the 'Universal Services Directive'), http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32002L0022:en:NOT.