Comments of Cisco Systems, Inc.
Ofcom Discussion Document on Traffic Management and Net Neutrality

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Cisco Response to Ofcom Discussion Document on Traffic Management and Net Neutrality

Introduction

Cisco Systems, Inc. is the world's largest manufacturer of networking equipment and a market leader in the provision of network management solutions and applications that require appropriate network management. Cisco welcomes the opportunity to provide comments in the context of the "Traffic Management and Net Neutrality" consultation published by Ofcom on 24th June 2010. [1]

As a company, Cisco has long supported an open and innovative Internet and continues to do so. Many of the Internet's benefits come from its open nature and the ability of anyone to develop new and innovative devices and services that connect to it. Such innovation has created entirely new industries and has fostered competitive markets in Internet applications and equipment. Recognizing these advantages, Cisco helped produce the High Tech Broadband Coalition's "*Connectivity Principles*" in 2003[2], which were reflected in the FCC's Policy Statement of 2005.[3]

Consumers, within the bandwidth limits and quality of services of their service plans should:

a) Have access to their choice of legal Internet content;
b) Be able to run applications of their choice;
c) Attach any devices they choose to their broadband Internet access;
d) And fourth and most important, receive meaningful information regarding their broadband Internet access service plans.

Similar connectivity principles have also been embedded in the revised framework Directive, which establishes that national regulatory authorities shall promote the interests of the citizens by, inter alia, promoting the ability of end users to access and distribute information or run

[1] http://stakeholders.ofcom.org.uk/consultations/net-neutrality/
[2] High Tech Broadband Coalition Letter to Chairman Powell, CS Docket No. 02-52; GN Docket No. 00-185; CC Docket Nos. 02-33, 95-20 & 98-10 (Sept. 25, 2003) ("HTBC Letter").
[3] *See Appropriate Framework for Broadband Access to the Internet Over Wireline Facilities*, Policy Statement, 20 FCC Rcd 14986 (2005) ("*Internet Policy Statement*")

applications and services of their choice.[4] The new revised framework also includes a number of provisions to enhance consumer transparency.[5]

We fully embrace these connectivity principles, and the provisions to enhance consumer transparency, and believe they protect consumers from arbitrary and unnecessary limitations on their Internet usage.

We also believe an 'open' and competitive Internet must include the ability of network operators to innovate within the Internet so it must permit network management and managed services (such as high definition video conferencing like TelePresence or HealthPresence) to offer consumers additional choice through tiering, quality of service, security services, and other network management techniques. These services today are mainly offered via private networks and as enterprise managed services or specialized services outside the Internet. In the future, they could be offered over the Internet, and the evolution of the Internet should allow for these new services to emerge for the benefit of the consumers.

Besides the issues around the network management debate, and the related consumer protection issues, there is also a fundamental economic debate around business models which is well described in Ofcom's discussion document, in the sections related to the 'two-sided' markets and charging for access to consumers. We believe service providers should retain the ability to offer differentiated services at different prices, which in itself requires traffic management to recognize types of traffic and act accordingly, and explore new cost sharing business models. The future business models for the broadband Internet are still evolving and being tested, and it is not entirely clear that the single-sided, subscriber pays a flat rate model is always in the best interests of consumers.

Finally, as a general remark to our contribution, we believe any discussion on traffic management and the need for potential regulatory intervention, should be limited to the public Internet service, and not focus on additional managed services or enterprise VPNs.

i) How enduring do you think congestion problems are likely to be on different networks and for different players?

Theoretically, designing an IP network for low-delay, low-jitter and low-loss can be relatively simple: one simply needs to over-provision the bandwidth compared to the actual load. [6]

[4] Article 8g Revised Framework Directive

[5] In particular, Articles 21 and 22 of the Citizen's rights Directive (Directive 2009/136/EC)

[6] Thomas Bonald, Alexandre Proutiere, James Roberts, "Statistical Guarantees for Streaming Flows Using Expedited Forwarding", INFOCOM 2001; Steve Casner, Cengiz Alaettinoglu, Chia-Chee Kuan, "A Fine-Grained View of High-Performance Networking", Packet Design, NANOG 22, May 20-22, 2001; Anna Charny and Jean-Yves Le

Aggregate over-provisioning of bandwidth, however, represents an expensive option for the SP and in practice, it can be difficult or economically not viable to ensure over-provisioning in the presence of the following cases:

- Denial of service attacks
- Network failure conditions
- Capacity planning failures
- Network failure situations
- Unexpected traffic demands / bandwidth unavailability

In cases such as these, without IP QOS and enhanced network management, all traffic will share the same fate and all services will be impacted. This problem is even more challenging on lower-speed links, i.e. more typical of access networks, or in wireless networks, given bandwidth constraints and shared resources.

It is clear that going forward providers will need to enhance capacity, but relying on new capacity alone to solve current bandwidth limitations is not a solution. Both, network management and capacity enhancement will effectively maximize the consumer experience. Network providers therefore need to be able to manage networks in a flexible, reasonable and intelligent way. Network techniques such as for example IP routing, or Packet Differentiation ("DiffServ"), are used to alleviate congestion, ameliorate capacity constraints and enable new services in a cost effective way. We provide further details on the use of management techniques in our response to question iii) below.

ii) What do you think are possible incentives for potentially unfair discrimination?

iv) Do you think that unconstrained traffic management has the potential for (or is already causing) consumer/citizen harm? Please include any relevant evidence

v) Can you provide any evidence that allowing traffic management has a negative impact on innovation?

Questions ii), iv) and v) seek views on possible incentives for potentially unfair discrimination and negative impact/consumer harm resulting from network management.

As regards the question on possible incentives for potentially unfair discrimination, we believe competitive broadband markets, both retail and wholesale, are the best way to protect everyone's interests and diminish the incentives for potentially unfair discrimination. If customers have a wide choice of Internet access providers, which seems to be the case in the UK, are well

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Boudec, "Delay bounds in a network with aggregate scheduling", in First International Workshop on Quality of future Internet Services, Berlin, Germany, 2000.

informed about the characteristics of their broadband plans, and are able to switch between providers without penalty subject to their contracts, the potential for unfair discrimination or traffic management resulting in consumer harm is substantially mitigated.

With regard to the questions on potential negative impact of traffic management or unconstrained traffic management, as explained in more detail in our response to question iii) below, the essence of traffic management is to provide a better consumer experience. The growing demands placed on broadband networks threaten the user experience and the value of the network, and enhanced network management offers a viable, intelligent and tailored means of addressing those demands.

Clearly, operators should not be allowed to block or degrade any lawful traffic in a way that harms competition or consumers, and network management techniques should be reasonable, and not be used in an arbitrary way. At the same time, management tools should allow for differentiation and innovative business plans.

In any event, competition laws always apply and regulators have additional safeguards and tools to intervene on a case-by-case basis in case of anti-competitive or unfair blocking or degradation that harms consumers or competition. In this respect, we share Ofcom's views that generally market power would need to be substantial for regulatory concerns to be triggered by discriminatory traffic management policies.

Finally, we have not seen any evidence that free engagement in traffic management by ISPs leads to content providers 'overcharging' content providers for access to consumers. In the case of 'two-sided' markets, we believe it is important that providers retain the ability to engage in 'cost sharing' models, which in some cases may imply charging content and applications providers. This can be both more efficient and equitable with lower transaction costs, while reducing broadband costs for consumers to increase adoption.

As Ofcom suggests in its consultation, this is a period of considerably change, and relationships in the value chain are no longer fixed, so it would be premature and counterproductive to support one part of the sector over another, or to replace what should be a purely commercial relationship between the different actors in the value chain with regulatory arbitrage.

iii) Can you provide any evidence of economic or consumer value generated by traffic management?

There are many valid and pro-competitive reasons why a broadband Internet access provider might wish to 'manage' traffic on its network: to maintain network security, controlling the proliferation of spam, spyware, worms, and other 'malware'; to provide parents appropriate discretion over the content accessed by children; to hamper the unlawful dissemination of

intellectual property; to ensure quality of service is maintained as the demands placed on the Internet skyrocket, and perhaps, most significantly, to enable new managed services.

Internet usage is increasingly driven by high-bandwidth applications including online gaming, video over IP, voice over IP, and peer-to-peer (P2P) file exchange services. Cisco forecasts that annual global IP traffic will increase by a factor of four from 2009 to 2014, and the various forms of video (TV, VoD, Internet Video, and P2P) will exceed 91 percent of global consumer traffic. By 2014, global online video will approach 57 percent of consumer Internet traffic (up from 40 percent in 2010). [7]

This dramatic growth will come from a range of applications and services, driven by video, that have different requirements. Some will need high speed download capacity that is not time sensitive. Others will use high bandwidth one-way streaming in which latency is a factor. Other applications, such as VoIP, will not require high bandwidth but will be symmetric and need very low latency. And some, like TelePresence and other high definition real time two-way video, will require very high symmetric bandwidth, low latency, and no jitter. In other words, different applications will require differing network requirements and, as a result, the optimal network will adapt in order to be 'fit for purpose.' Network operators deploy tools to ensure that packets associated with latency- and jitter-sensitive applications arrive on time, and that the end user's experience is not disrupted by network congestion.

New Services/Applications Place New Demands on the Service Provider's Infrastructure

Service/ Application	Symmetry	Bandwidth Consumption	Delay Req'ts	Packet Loss Req'ts
Voice	Symmetric	17-106kbps Constant	<150ms (1-way)	< 1%
Broadcast Video	Asymmetric	2 – 15Mbps Vari. Or Const	Consistent (< 30ms)	<.0001%
Telepresence	Symmetric	4 – 11Mbps Variable	<150ms (1-way)	<.05%
Data	Asymmetric	TCP Adapts to BW Avail. Bursty	Delay Insensitive	Drop Insensitive

[7] http://www.cisco.com/en/US/netsol/ns827/networking_solutions_sub_solution.html#~forecast.

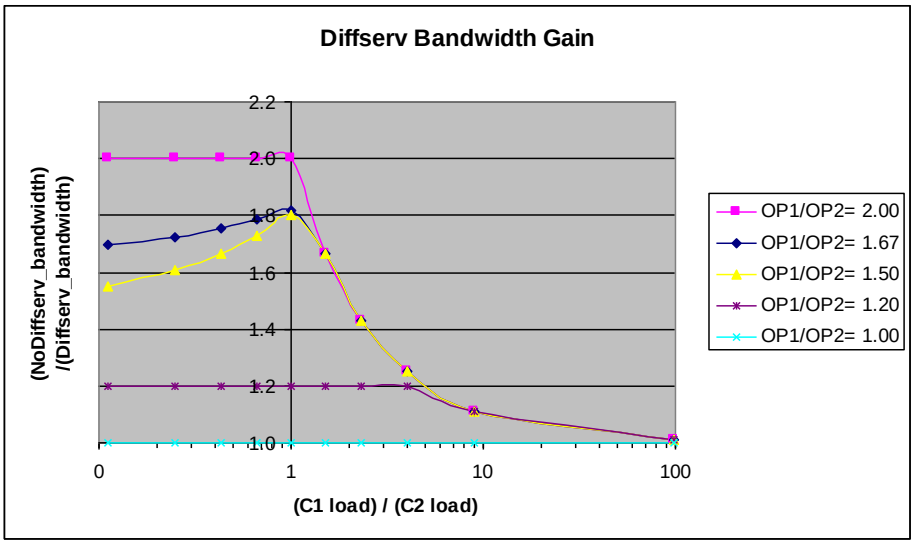
One of the tools used to enable QoS is Packet differentiation ("DiffServ"), which allows for IP quality of service distinctions to be applied to various groupings of network traffic. DiffServ gives SPs the flexibility to have different over-provisioning factors (the ratio of offered load to available capacity) for each service class, thereby providing SLA differentiation and making more efficient use of network capacity. For example, this could allow the VoIP class capacity to be over-provisioned by a factor of at least 2 relative to the average class load, hence ensuring that the class receives low delay, low jitter and low loss service, whilst the aggregate capacity could be over-provisioned by a lower factor, such as 1.2, which is a realistic figure still giving good service. This would result in a bandwidth saving over the non-DiffServ case. In practice as network links are provisioned in bandwidth increments, this may result in one lower bandwidth increment or one less link being required, which clearly has an associated cost saving.

DiffServ also provides isolation between different services classes; in unforeseen congestion; different services no longer need to share the same fate as DiffServ ensures that issues in one service class are isolated from impacting other classes.

The benefit of DiffServ can be realised either in terms of less bandwidth being required per link to achieve the same SLAs when compared to the non-DiffServ case, or in more aggregate traffic being supported for the same provisioned bandwidth as the non-DiffServ case. Figure 1 below illustrates the Diffserv bandwidth gain expressed as the bandwidth required without DiffServ divided by the bandwidth required with DiffServ, to achieve the same SLAs, for different relative loads of two traffic classes C1 and C2, and for different ratios of class over provisioning factors (i.e. OP1 / OP2), where OP1 = 1.[8]

[8] The most significant relative benefits in terms of bandwidth savings from deploying DiffServ are achieved when the proportion of Class 1 load (the class with the tightest SLA commitment and therefore the highest over provisioning factor) is low relative to the Class 2 load, and when the ratio of the over provisioning factor for Class 1 is high relative to the over provisioning factor for Class 2 (i.e. OP1 / OP2).

Figure 1. Diffserv bandwidth gain (Cisco owned research)



Managing networks for quality of service (QoS), as explained above, allows for a growing set of consumer and business applications that offer great value to individuals and society: applications such as telemedicine, emergency alerts and real-time energy management. For these applications, it is absolutely necessary that the correct packets arrive at their destination at the correct time.

As Ofcom recognises, consumers will have different needs and tastes. Some consumers will prefer to pay a lower fee to have access to Internet services with no guaranteed quality of service, but others may be willing to pay an extra fee to benefit from new services, which may require boosting the quality of service or enhanced security. Lower cost options may be an important tool in incenting increased broadband adoption, particularly among lower income populations.

Today, service providers already offer various broadband plans at different prices depending on the broadband speeds, monthly usage, etc. [9] In the future, new business models will emerge, and services addressed to specific needs (e.g. a specialised service addressed to on-line gamers or specialised delay sensitive services such as healthpresence at home) with varying pricing conditions may be launched for the benefit of consumers/citizens who are willing to pay for it. [10]

[9] http://www.belgacom.be/private/fr/jsp/dynamic/productCategory.jsp?dcrName=bun_nettv&detailPage=bun_nettv_feature#1; http://www.productsandservices.bt.com/consumerProducts/displayCategory.do?categoryId=CON-TOTAL-BB-R1

[10] Another example is around broadcasting. More and more television vendors are announcing High Definition TVs directly connected to the Internet, which will continue to increase the amount of traffic over the internet and put pressure on the network, requiring both higher capacities and the use of quality of service and other tools to ensure an adequate experience. http://www.electronichouse.com/article/google_tv_announcement_roundup/. These services may be free of charge but may also be offered for an additional price.

Today, these specialized services are typically offered to enterprises over dedicated facilities entirely segregated from the "public internet", or to the consumers over infrastructure shared with broadband Internet access services, but outside the internet (e.g. bundled IPTV offers over ADSL etc.). As explained above, in the future managed services are likely to rely on customers' own Internet customer links in the last mile, to the extent those links can be provisioned to ensure sufficient quality of service.

We think that these new specialized services can develop in a way it does not interfere with the continued robustness of the internet access service as such, in particular as the deployment of next generation access networks offering higher speeds accelerates both in the UK and in Europe. However, it is important that consumers are informed on the technical properties of their internet access, and in particular on the way internet access potentially shares capacity resources with other specialized or managed services. It is also important to remember specialized services are an additional choice offered to consumers, and when not used, the full bandwidth capacity will become available for their internet access service. As such, the deployment of specialized or managed services provides revenue that helps pay for the investment in better access networks which improves the overall bandwidth available to consumers.

As the market for specialized or managed services remains nascent, the appropriate policy should be to monitor the development of the market and only take action if measures are necessary to ensure the robustness of the broadband internet access.

iv) (see above)

v) (see above)

vi) Ofcom's preliminary view is that there is currently insufficient evidence to justify *ex ante* regulation to prohibit certain forms of traffic management. Are you aware of evidence that contradicts this view?

We believe Europe has a very robust competition and sector-specific regulatory framework. Besides competition rules, the revised telecoms framework has introduced a new set of transparency rules to ensure consumers make informed choices regarding their Internet services. In addition, regulatory authorities now have the ability to intervene by setting minimum quality of services, in order to prevent a possible degradation of service quality for consumers. [11]

Given the fact that there have been virtually no instances of anti-competitive discrimination in the UK, and that the broadband market place is very competitive, and increasingly competitive, we do not believe new ex-ante regulation is needed.

In this increasingly competitive broadband market, a provider found to be engaging in traffic degradation, blocking, or other negative behaviour for anticompetitive reasons would quickly

[11] Article 22.3. of the revised citizen's rights Directive (Directive 2009/136/EC)

lose customers to its competitors. This competitive pressure has been extremely effective in ensuring that providers comply with the preferences of their users – and there is no reason to doubt that it will continue to be effective in the future.

As some point, it might be necessary to clarify the reserved power foreseen in article 22.3. This could be done by issuing guidelines to regulators, either by the European institutions, or by BEREC. However, we would have strong reservations about any proposals which define *ex-ante* which management practices are acceptable and which ones are not, beyond general provisions to avoid blocking or degradation in an anti-competitive way. Limiting the types of traffic management *ex-ante* would also impose arbitrary limits in the ways networks services and applications would be offered and would not protect consumers. We would also be concerned if a pure non-discrimination requirement would be adopted.

vii) Ofcom's preliminary view is that more should be done to increase consumer transparency around traffic management. Do you think doing so would sufficiently address any potential concerns and why?

viii) How can information on traffic management be presented so that it is accessible and meaningful to consumers, both in understanding the restrictions on their existing offering, and in choosing between rival offerings? Can you give examples of useful approaches to informing consumers about complex issues, including from other sectors?

ix) How can compliance with transparency obligations best be verified?

As mentioned earlier, we believe that competitive broadband markets coupled with enhanced consumer transparency will, in principle, be sufficient to address any potential concerns regarding the openness of the Internet.

Consumers should be entitled to accurate and relevant information in plain language about the characteristics and capabilities of their offerings, their broadband network management, and other practices necessary for them to make informed choices.

We support Ofcom's views that more should be done to improve consumer transparency around traffic management practices in line with the enhanced transparency provisions which were adopted in the revised Telecom Framework. The question is to identify the appropriate level of detail that is required for consumers to be able to make an informed choice without creating too much confusion. It is also important that these requirements do not create an undue burden on industry. We share Ofcom's concerns that simply providing large amounts of information can be ineffective or even increase consumer confusion.

x) Under what circumstances do you think the imposition of a minimum quality of service would be appropriate and why?

Generally, we view Article 22.3 of the Citizens' Directive granting the authority the possibility of imposing minimum quality of services as a reserved power, in case neither competition law nor sector specific regulation and transparency rules are sufficient to deal with instances of blocking or serious degradation which harm consumers and competition.

However, we do not believe the imposition of a minimum quality of service will deliver value at this stage. Also, if in the future regulators decide a minimum quality of service is required, this should be done in the form of European Guidelines issued by the Commission or by BEREC. It would be against the objective of a single telecoms market to have different interpretations of what minimum quality of service means across the Community. Finally, regulators should be extremely careful and avoid unintended consequences to the detriment of consumer choice and innovation.

This would be the case, for example, if the minimum quality of services provision is interpreted in a way that does not allow operators to offer tiered quality of services, or if limited services plans would not be allowed.

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Cisco looks forward to continue working with Ofcom as it examines these challenging issues. For any questions or additional information regarding this submission, please contact:

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