



# Knocking Down Strawmen

Vinton G. Cerf • Google

**M**uch has been made of the terms “net neutrality” and “openness” in connection with the Internet. Many who argue against the importance and preservation of these properties interpret these terms in ways that enable their arguments. For the most part, I consider many of these interpretations to be deliberately fabricated so as to make them easy to knock down and thus belittle proponents of neutrality and openness. The Internet has always been characterized as a best-efforts system that doesn’t make guarantees as to delivery, latency, or even sequence of arrival. The protocols that are used to implement it are intended to be resilient in the face of a variety of failures.

Among the misinterpretations of neutrality, we find “every packet must be treated identically.” In fact, the intent is more along the lines of “equal potential for impairment.” The Internet’s philosophy is that it will do the best it can to service any arriving packet, but it’s free to drop the packet or shape the traffic to protect network resources, deal with congestion, and provide fair access to its facilities. Naysayers will argue that the network’s implementation isn’t neutral unless every packet receives identical treatment. This is a strawman argument. The network should be essentially indiscriminate with regard to origin or traffic destination, and should supply its best efforts to deliver packets while considering limits to capacity. User choice should be protected so that network access providers don’t accidentally or intentionally create limits on users’ choices of application or destination within some framework of fairness.

Any particular Internet network does have finite capacity and will be subject to congestion. Moreover, network operators must respond to congestion to limit the load to available capacity. At the Internet’s edges, one limiting factor

is the bandwidth of the access network. It isn’t a violation of neutrality to limit users at the Internet’s edge to a maximum bandwidth for which they might have paid. Neutrality doesn’t mean that providers can’t charge for more usage. During periods of congestion, we might expect that users paying for more capacity would be permitted to consume a larger portion of what’s available than those paying for less peak capacity.

Some Internet access providers limit the total number of bytes users can send or receive in the course of a billing period (for example, a month). Such practices are a weak proxy for shaping traffic to fit within the immediately available bandwidth at the network edge. The network is somewhat insensitive to sending traffic at rates that are low relative to the available bandwidth. The limiting factor is the rate of transmission more than the total number of bytes sent or received. A terabyte in a month puts far less pressure on available network resources than a terabyte in 10 seconds.

Recall that packet switching takes advantage of statistical multiplexing. Each user has momentary access to the maximum bandwidth of his or her access channel, but all that capacity is available to others. The system assumes that statistical sharing produces a better average experience for all users until the system approaches congestion, at which point providers must understandably impose traffic shaping and fair allocation of capacity.

Many of the arguments against neutral treatment are based on the finite nature of the capacity of the Internet or its access networks. In fact, over time, the Internet has grown dramatically in capacity, not only in scale but also in the maximum data rates at the edges and in the core. The Arpanet had only 50 Kbytes/s to offer in the core, but today’s optical fiber networks operate

*cont. on p. 87*

cont. from p. 88

at 100 Gbytes/s — a factor of two million! The Internet's neutral posture has allowed any new and all existing applications equal opportunity to access this vastly increased capacity. A rising tide raises all boats, and so it is with the Internet.

None of these arguments are intended to defeat reasonable efforts to protect users' interests (for instance, fair access, protection from harm, or network availability), although we might reasonably have different views as to how these protections should be implemented. Some protections might be better implemented elsewhere besides the Internet's basic packet-carrying layers.

Regarding openness, it seems fair to say that the Internet's architecture and philosophy have permitted it to absorb and use just about every communication technology that developed since its conception in 1973. The IP layer is insensitive to the medium by which packets are carried and is also ignorant of the applications that generate and consume those packets. Some have argued that the Internet could do a better job of adapting its resources if it could know in advance what an application's usage pattern might be (low-latency games, high-capacity video streaming, high-rate file transfers, latency-tolerating email, and so on). Although you could make a case for this, the convergence of all types of data transfer within a single application (as with the Web) begs classification questions. The intent of the open Internet mantra is simply that the Internet won't dictate what applications are mounted or used but, rather, will do the best it can to serve them. This posture has led to an unbounded number of new applications, none of which had to get permission from all ISPs in the world to be mounted and offered or used. Of course, some will work poorly if the available capacity is inadequate to the task. Openness also implies freedom to invent new

protocols to support new applications. The layering of the protocol stack has enabled horizontal expansion in protocol space at each layer.

Here is perhaps a crux of the debate. For some, the present limits on available capacity should dictate implementation of mechanisms to guarantee that particular applications will work. For others, myself included, the opportunity to gain access to the Internet's increasing capacity without rigid classification is the incentive for inventing new and useful applications, new protocols, and new transmission technology.

We can add another interpretation of the term openness: freedom to speak and to hear. Many of us believe the Internet and the Web have enhanced these freedoms immeasurably. To these freedoms, I think we must also add freedom from harm, which leads to understandable concerns about and desires to protect users from malware, denial-of-service attacks, identify theft, and a host of other ills that are found in the Internet environment. It's fair to say that protecting these freedoms is a shared responsibility among the Internet's users and providers, law enforcement, and the regulatory frameworks used worldwide. The Internet is a global system, and protection of user freedoms will require the cooperation and harmonization of national and international practices, to the extent practicable. □

**Vinton G. Cerf** is vice president and chief Internet evangelist at Google, and past president of ACM. He's widely known as one of the "fathers of the Internet." He's a fellow of IEEE and ACM. Contact him at [vint@google.com](mailto:vint@google.com).



Selected CS articles and columns are also available for free at <http://ComputingNow.computer.org>.

**PURPOSE:** The IEEE Computer Society is the world's largest association of computing professionals and is the leading provider of technical information in the field. Visit our website at [www.computer.org](http://www.computer.org).

**OMBUDSMAN:** Email [help@computer.org](mailto:help@computer.org).

**Next Board Meeting:** 16–17 November 2014, New Brunswick, NJ, USA

#### EXECUTIVE COMMITTEE

**President:** Dejan S. Milojicic

**President-Elect:** Thomas M. Conte; **Past President:** David Alan Grier; **Secretary:** David S. Ebert;

**Treasurer:** Charlene ("Chuck") J. Walrad; **VP,**

**Educational Activities:** Phillip Laplante; **VP,**

**Member & Geographic Activities:** Elizabeth

L. Burd; **VP, Publications:** Jean-Luc Gaudiot;

**VP, Professional Activities:** Donald F. Shafer;

**VP, Standards Activities:** James W. Moore; **VP,**

**Technical & Conference Activities:** Cecilia Metra;

**2014 IEEE Director & Delegate Division VIII:** Roger

U. Fujii; **2014 IEEE Director & Delegate Division V:**

Susan K. (Kathy) Land; **2014 IEEE Director-Elect &**

**Delegate Division VIII:** John W. Walz

#### BOARD OF GOVERNORS

**Term Expiring 2014:** Jose Ignacio Castillo

Velazquez, David S. Ebert, Hakan Erdogmus, Gargi

Keeni, Fabrizio Lombardi, Hironori Kasahara,

Arnold N. Pears

**Term Expiring 2015:** Ann DeMarle, Cecilia Metra,

Nita Patel, Diomidis Spinellis, Phillip Laplante,

Jean-Luc Gaudiot, Stefano Zanero

**Term Expiring 2016:** David A. Bader, Pierre

Bourque, Dennis Frailey, Jill I. Gostin, Atsuhiko

Goto, Rob Reilly, Christina M. Schober

#### EXECUTIVE STAFF

**Executive Director:** Angela R. Burgess; **Associate**

**Executive Director & Director, Governance:** Anne

Marie Kelly; **Director, Finance & Accounting:**

John Miller; **Director, Information Technology**

**& Services:** Ray Kahn; **Director, Membership**

**Development:** Eric Berkowitz; **Director, Products**

**& Services:** Evan Butterfield; **Director, Sales &**

**Marketing:** Chris Jensen

#### COMPUTER SOCIETY OFFICES

**Washington, D.C.:** 2001 L St., Ste. 700,

Washington, D.C. 20036-4928

**Phone:** +1 202 371 0101 • **Fax:** +1 202 728 9614

**Email:** [hq.ofc@computer.org](mailto:hq.ofc@computer.org)

**Los Alamitos:** 10662 Los Vaqueros Circle, Los

Alamitos, CA 90720 • **Phone:** +1 714 821 8380 •

**Email:** [help@computer.org](mailto:help@computer.org)

**Membership & Publication Orders**

**Phone:** +1 800 272 6657 • **Fax:** +1 714 821 4641 •

**Email:** [help@computer.org](mailto:help@computer.org)

**Asia/Pacific:** Watanabe Building, 1-4-2 Minami-

Aoyama, Minato-ku, Tokyo 107-0062, Japan •

**Phone:** +81 3 3408 3118 • **Fax:** +81 3 3408 3553 •

**Email:** [tokyo.ofc@computer.org](mailto:tokyo.ofc@computer.org)

#### IEEE BOARD OF DIRECTORS

**President:** J. Roberto de Marca; **President-Elect:**

Howard E. Michel; **Past President:** Peter W.

Staecker; **Secretary:** Marko Delimar; **Treasurer:**

John T. Barr; **Director & President, IEEE-USA:**

Gary L. Blank; **Director & President, Standards**

**Association:** Karen Bartleson; **Director & VP,**

**Educational Activities:** Saurabh Sinha; **Director &**

**VP, Membership and Geographic Activities:** Ralph

M. Ford; **Director & VP, Publication Services and**

**Products:** Gianluca Setti; **Director & VP, Technical**

**Activities:** Jacek M. Zurada; **Director & Delegate**

**Division V:** Susan K. (Kathy) Land; **Director &**

**Delegate Division VIII:** Roger U. Fujii