DECLARATION OF HENRY (HANK) KILMER, VICE PRESIDENT OF IP ENGINEERING, COGENT COMMUNICATIONS HOLDINGS, INC.

August 25, 2014

I. Introduction

1. My name is Hank Kilmer. I am the Vice President of IP Engineering for Cogent Communications Holdings, Inc. ("Cogent"). Prior to joining Cogent, I served as the CTO for GPX Global Systems, Inc. which builds state-of-the-art carrier neutral data centers in rapidly developing commercial markets of the Middle East North Africa (MENA) and South Asia regions. Before joining GPX, I was Senior VP of Network Engineering for Abovenet (Metromedia Fiber Network, MFN). My tenure in the industry also includes positions with UUNET, Sprint and Intermedia/Digex, and I served on the first Advisory Council for ARIN, the American Registry of Internet Numbers.

2. The purpose of this declaration is to provide background information on the various means by which different Internet networks carry data, and to address certain aspects of Cogent's recent dealings with Comcast.

3. Part II provides a brief overview of Cogent's business. Part III describes peering and transit services, including an overview of participants in the Internet distribution chain and a discussion of competition in the provision of transit services. Part IV explains why Comcast and Time Warner Cable ("TWC"), though not Tier 1 networks (i.e., transit free), have obtained settlement-free peering, and gives a brief overview of Internet access technologies other than cable. Part V discusses certain facets of Cogent's recent dealings with Comcast.

II. Cogent Communications Holdings, Inc.

4. Cogent is a leading facilities-based provider of low-cost, high-speed Internet access and Internet Protocol ("IP") communications services. We are a Tier 1 Internet service provider ("ISP") with a network that, among other things, carries Internet traffic from edge providers across thousands of miles to other ISPs and to our own business customers. Cogent is consistently ranked as one of the top five Internet networks in the world.[1]

5. Cogent's network serves over 180 metropolitan markets in North America, Europe and Japan and encompasses:

- over 1,425 multi-tenant office buildings strategically located in commercial business districts;
- over 650 carrier-neutral Internet aggregation facilities, data centers and single-tenant buildings;
- over 600 intra-city networks consisting of over 27,000 fiber miles
- an inter-city network of more than 57,500 fiber route miles; and

[1] For one such measurement see http://as-rank.caida.org/.

- multiple high-capacity transatlantic and transpacific circuits that connect the North American, European and Japanese portions of our network.

6. Cogent provides Internet transit services to customers with a broad range of data needs. While no single customer accounted for more than 1.4% of Cogent's 2013 revenues, certain customers transit high volumes of data over Cogent's network.

7. Cogent measures the volume of Internet packets on its network at each interconnection point throughout its network. That data has allowed Cogent to continually increase the capacity of its network as necessary to avoid congestion and packet loss. Consequently, Cogent's network does not experience dropped packets except during fiber cuts, sudden peering discontinuances, and similar outages. Any sustained packet loss experienced by Cogent's customers can be attributed to congested interconnection points with our peering partners, which is outside of Cogent's sole control.

8. Cogent's network can be upgraded in a variety of ways, including increasing the number of ports and/or by adding wavelengths on our optical fiber network. Such upgrades allow greater customer throughput in a highly scalable manner. Over the past 5 years, the volume of Internet traffic carried by Cogent's network has increased from approximately 2,226,229 TBytes to 18,155,339 TBytes per year (an increase of 716 percent). Cogent has accommodated that increase with capital expenditures averaging $48 million per year.

III. Peering and Transit Services

A. Introduction to Peering/Transit

9. In order to explain peering and transit arrangements, I will first briefly discuss how entities connect to the Internet, including through the use of both peering and transit, and then describe how transit services are sold. I will also describe the different "tiers" of ISPs.

10. The Internet is often described as a "network of networks." It originated from a peering agreement between ARPAnet, a network managed by the Advanced Research Projects Agency of the Department of Defense, and CSNet, a network managed by the National Science Foundation ("NSF"). This interconnection arrangement was initially hampered by problems of allocating costs between the two agencies until they settled upon the concept of "settlement-free" peering—both sides would pay for the cost of their networks and share the interconnection costs without allocating the relative costs of data travelling over the network.

11. This interconnected network became known as NSFNET. By the early 1990s, NSFNET, was the backbone of what would become the modern Internet. In 1996, NSF transitioned the network to private control, turning over the operation of the Internet to ISPs who initially interconnected through four National Access Points. Today, the global Internet connects traffic from over 47,000 independent networks at approximately 200 well-recognized interconnection points around the world.

12. A network can connect to the Internet in one of two ways: (1) it can agree to exchange traffic directly with other networks that are part of the Internet—referred to as peering, or (2) it

can contract with a network that sells it access to the global Internet—referred to as transit. The key technical distinction is that in peering, the two networks agree to exchange only traffic originating and terminating on each network's customers. For example, networks A and B might agree to peer and exchange traffic. To exchange traffic with network C, however, both network A and network B would have to agree, separately, to peer with network C and exchange traffic. A customer or another network that purchased transit from networks A, B, or C would receive access to all the networks (A, B, and C).

1. Tier 1 Networks

13. When the Internet transitioned to the private sector, the largest networks that interconnected with one another, including PSINet, whose assets were subsequently acquired by Cogent, were the first Tier 1 networks. These networks connected directly with each other through settlement-free peering arrangements, much like the initial arrangement between ARPAnet and CSNet. In general, these connections were accomplished informally. Two network engineers would agree to exchange traffic at a location and the connection would be established. There was no written contract or business arrangement. It was just engineers agreeing to connections to facilitate the exchange of traffic. Only end-user customers (whether business or consumer) or edge providers paid for a connection to the Internet. The networks that composed the backbone of the Internet simply exchanged traffic to make the Internet work.

a. Settlement-Free Peering between Tier 1 Networks

14. Whether a network has settlement-free peering with other Tier 1 networks defines whether that network is deemed a Tier 1 network. Tier 1 networks apply stringent standards to peer with others on a settlement-free basis. At a basic level, a network must demonstrate that it is of a size, geographic scope, capacity, traffic volume and significance to merit a settlement-free peering agreement with another network. In practice, the willingness of Tier 1 networks to agree to settlement-free peering is often driven by an assessment of how that network will fare in the absence of an interconnection. When a Tier 1 network is not fully connected to the Internet as a result of a peering dispute, both networks risk losing transit customers who no longer have access to networks they need. When disputes arise, this dynamic usually forces both networks to the bargaining table. Cogent has had numerous instances where other Tier 1 networks have either threatened to de-peer or have actually de-peered it and, in every case, the dispute was resolved with the continuation of settlement-free peering.

15. Cogent's major disputes in the last ten years that have resulted in de-peering by other Tier 1 carriers are listed below. In each case the peering relationship was re-established.

- AOL in 2003. The peering relationship was restored in 2008.
- Teleglobe in 2005. The peering relationship was restored after a few days.
- France Telecom in April 2005. The peering relationship was restored in 2006.
- Level 3 in October 2005. The peering relationship was restored after a few days.

- Sprint in 2008. The peering relationship was restored after a few days.

16. There are no precise rules for the appropriate criteria that define whether two Tier 1 networks should enter into a settlement-free peering agreement. Common requirements are understood in the industry to include:

- Size of Network—The relative size of the two networks, in terms of total connections and aggregate traffic flow over the entire network, provides a good metric for evaluating the value to each network of settlement-free peering.

- Geographic reach and multiple interconnect points—Networks often have different geographic coverage. At a minimum, the networks generally should have comparable reach and the ability to interconnect at multiple locations.

- Traffic minimums—Unless there is a significant flow of traffic between the two networks, incurring the fixed interconnection costs may not be the most cost-effective way of exchanging traffic between the two networks.

- Proper maintenance of a connection—Networks generally expect that an interconnection will be well maintained, i.e. that each side will be available to address concerns and that both sides commit to upgrade connections when they reach approximately 70% capacity, though discussions and negotiations typically begin prior to capacity reaching that level. Such conversations and the implementation of measures to address capacity constraints are important because packet loss tends to occur once ports are about 90% utilized.

17. Certain Tier 1 providers also include a traffic ratio requirement. These "Not to Exceed" ratios establish an out/in ratio that peering traffic should not exceed. From Cogent's perspective, this requirement is irrational and exists only to create a pretext for denying peering agreements a network otherwise wants to avoid or to obtain some perceived negotiating leverage. The direction of traffic generally doesn't matter as long as the exchange of traffic is valuable to both networks. I will further address the reasons why ratio requirements are irrational in ¶¶ 55-60.

18. The physical interconnection between two Tier 1 networks consists of the following:

- Both networks build their network into a carrier neutral data facility (co-location facility), which is a data center that is run by a third party that allows multiple carriers and customers to rent space at the data center;

- Both networks must maintain a router at the co-location facility; and

- Both networks must maintain the appropriate number of ports and "cross connects" between each other's routers and within their own network infrastructure.

19. Once established in a carrier neutral data facility, the cost of increasing the capacity of the interconnection between the two peers is minimal. Capacity is typically increased by adding additional interconnections that carry traffic at 10 Gbps. If the network operator has an available 10 Gbps port on its router then the only cost to the operator is the operator's share of the fee

charged by the data facility for optical fiber that connects the ports of the two operators. That charge is typically $200 per month. The operators generally alternate paying for this cross connect. Even if an operator has to add a port card to its router, the capital cost for each additional port is less than $10,000. Of course, this is just the cost for adding capacity to exchange traffic. It does not reflect any of the capital or operational costs of the operator's network, but Cogent regards those costs as relevant to the capacity of the network, which is a function of the capacity promised to the operator's customers. The network capacity is sized based on the data rates promised to customers, whether the data comes from peers or from within the network.

20. Setting the capacity of the interconnection points between two Tier 1 providers requires continuous monitoring of the traffic being exchanged between the two networks. Since it is not expensive to add additional connections, there is usually a preference to upgrade a connection long before the connection reaches full capacity. When a connection reaches about 70% of that connection's capacity, the two networks generally add additional capacity (i.e. additional ports and cross-connects). Capacity is measured using the 95th Percentile metric discussed in ¶¶ 21-22 below.

b. Transit

21. Tier 1 networks also connect with other networks or customers pursuant to transit agreements. Transit was initially sold for a flat monthly fee for given amount of capacity (whether used or not), e.g. $2000 per month for a connection capable of carrying up to 100 Mbps. However, this method of charging for access often discouraged those who did not use the full capacity of a line. The industry has ultimately settled on a system of metered service, calculated by using the 95th Percentile Measurement Method ("95/5").

22. The 95/5 measurement is based on collecting 5-minute samples of traffic. At the end of the month, those samples are converted to megabits per second, ranked by traffic volume per second, and measured at the 95th percentile to calculate the volume of traffic for that month. Most ISPs require a customer to commit to a certain amount of usage. This prevents customers from gaming the 95/5 measurement system by purchasing from multiple providers and effectively having traffic rates with each provider that is very high for 5% of traffic while the rest is very low. Actual volume may be more or less than a customer's commitment rate.

23. Transit is calculated by measuring both inbound and outbound traffic during the month and selecting whichever measurement is higher for calculating the volume of traffic. Given this method of pricing by the transit provider, the measurement that is relevant ultimately is the amount of traffic going back or forth. The direction of the traffic does not matter. Pricing is not impacted by distance that data must travel on Cogent's network or by ultimate destination. Transit customers with higher transit volumes generally get lower per unit rates.

24. It is also possible to purchase services other than transit. One example of such a service would be a "paid peering" arrangement, whereby two networks peer but one pays some form of compensation to the other network. Cogent only sells transit. Cogent does not sell or purchase peering, nor does it purchase transit services to reach any portion of the Internet.

2. Other Internet Participants

25. Beyond Tier 1 networks, there are various other participants in the Internet distribution chain. For present purposes, the most relevant are non-Tier 1 ISPs, content delivery networks, edge providers, and end-users.

26. ISPs that cannot obtain settlement-free or paid peering arrangements with Tier 1 networks typically pay for transit and are referred to as Tier 2 or Tier 3 networks. Some networks that purchase transit from Tier 1 providers also interconnect directly with other networks, thereby avoiding the cost of transit for traffic transmitted to those networks. ISPs that pay transit and also peer with other networks are generally referred to as Tier 2 networks. Finally, entities that are pure resellers, offering Internet service to customers only through purchased transit, are referred to as Tier 3 providers. In addition to being multichannel video programming distributors ("MVPDs"), most cable companies are Tier 2 or Tier 3 ISPs, providing Internet access over their cable networks. (Other examples of Tier 2 or Tier 3 ISPs include Lightower, Atlantech, Internap and Hurricane Electric.) Cogent has a number of transit agreements with cable companies. Comcast and TWC, although not Tier 1 networks, have been able to obtain settlement-free peering from certain Tier 1 providers, including Cogent, because of their market power arising from their control of access to the consumers who use them for broadband Internet service.

27. Content delivery networks ("CDNs") are networks of servers that, as the name suggests, facilitate the distribution of Internet content. CDNs accomplish this by locating servers with the content as close as possible to the networks that are delivering the content to consumers. CDNs reduce the demands on a central repository of data, for example, a server containing thousands of movies, and the demands on the connections to the repository. The CDN reduces the demand on the central server by caching copies of the most viewed movies near the consumers that want to view them. The following example explains how this works. Suppose a movie is stored (with many other movies) on a central server. If a consumer decides to watch the movie, a data stream is created from the central server to the consumer. If a second consumer wants to watch the same movie, a second data stream is created. If a CDN is being used, the first consumer's data stream containing the movie is copied into a server close to that consumer. If the second consumer is in the same geographic area as the first consumer then the movie will be delivered to that consumer from the nearest caching server, so the central server will have needed to create only a single data stream (for the first consumer). There are a number of potential variations on this approach, but all of them focus on storing content closer to the end user. An important aspect of this approach is that CDNs alter the peering landscape. Peering generally uses BGP's (Border Gateway Protocol) default of closest exit routing (also known as "hot potato routing"), but CDNs attempt to distribute the traffic to the closest cache to the end user. This greatly reduces the load carried by ISPs across their backbones but does not reduce the load in the last mile delivery to the end user. Examples of CDNs include Akamai, Limelight, and Amazon CloudFront.

28. Edge providers provide content, services, and applications over the Internet. Content providers are concerned with delivering their content to end users, but they are often equally concerned with speed and quality with which their content reaches end users. Examples of edge providers are Google, Hulu, Netflix and Skype.

29. End users are residential consumers and businesses that purchase Internet access from an ISP. Examples would include residential users of Comcast's broadband Internet service or corporate Internet access customers of Verizon or Cogent.

B. Settlement-free peering between Tier 1 ISPs has created a robust, competitive market for transit services

30. Having described the various Internet participants, I will now explain certain market dynamics associated with transit and peering relationships.

31. The market for transit services is highly competitive for a number of reasons. First, there are a significant number of Tier 1 networks that compete in providing transit service, some of which like Cogent, compete aggressively on price. Second, competition is further increased by the ability of Tier 2 networks to offer transit service, thus further increasing the number of competitors. Third, a transit customer can reduce the cost of transit and increase pressure for lower transit prices by entering into peering agreements with other networks, thus reducing the volume of transit traffic. Finally, customers also can use CDNs to reduce the volume of transit traffic.

32. There are a large number of sophisticated and competitive Tier 1 networks that offer transit to U.S. customers. Tier 1 networks are estimated to include: AT&T, CenturyLink, Cogent, Deutsche Telekom, GTT, Level 3 Communications, NTT Communications, Sprint, Tata Communications, Verizon Business, XO Communications, and Zayo Group.

33. Cogent has succeeded by offering significantly lower prices than its competitors. When Cogent started its business in 1999, it offered Internet access to customers at a price one hundred times less than the then-prevailing rate: 100 megabits-per-second for $1,000 per month, as compared to $1,500 for a 1.5 megabit-per-second connection. Similarly, at that time, Cogent offered data transit services at a price of $10 per megabit-per-second when the then-prevailing market rate was $300 per megabit-per-second in carrier neutral data centers. Over the past five years, Cogent has lowered its prices for data transit by approximately 22 percent per year, so that today we sell transit for an average price of $1.31 per megabit-per-second. This decline in price was facilitated by a decrease in the cost of expanding network capacity.

34. In addition to Tier 1 providers, Tier 2 and Tier 3 providers also offer transit services at competitive rates. Competition is based on many factors, including price, transmission speed, ease of access and use, breadth of service availability, reliability of service, customer support and brand recognition. Cogent continues to experience downward pricing pressure from competition with a wide variety of Tier 1, Tier 2 and Tier 3 providers.

35. Transit customers also can avoid the cost of transit by electing to peer directly with other networks with whom they exchange traffic or by using CDNs to reduce the cost of transit.

36. Tier 2 and Tier 3 ISPs can use peering to avoid the cost of transit. For example, if there are two networks that both purchase transit from a Tier 1 ISP and those networks are the end destination for each other's traffic, they can avoid the cost of transit by entering into a settlement-free peering arrangement with one another. Even if one of the two networks is not

interested in a settlement-free peering agreement, both companies could still agree to a paid peering arrangement. Under such an arrangement, the networks could end up paying less for paid peering then they were paying for transit simply by connecting directly to each other.

37. Content providers can also use a similar approach to avoid the cost of transit. If a content provider knows that a specific network is the end point for much of its traffic, it can seek a paid peering arrangement that permits it to send content directly to the network instead of through a Tier 1 ISP. Once again, in a competitive market, it is in the content provider's interest to do so as long as the cost for doing so is less than the cost of transit.

38. Networks and content providers easily can and do peer with each other. The process simply requires connecting within a co-location data center and paying to either connect directly or through the shared fabric of the IXP. An IXP is an Internet Exchange Point run by a co-location provider where service providers can interconnect through a shared network fabric. There are now hundreds of IXPs around the world which cater to networks seeking to connect with one another. Thus, even though the price of transit has been falling year over year, in some cases it may still be cheaper for a network to connect directly with other networks or content providers.

39. Content providers can also use CDNs to reduce the cost of transit, because there can be advantages to locating servers closer to customer connections. The content provider pays transit for a much smaller portion of traffic than it otherwise would—essentially the cost of the traffic from the end user to the content provider, the cost of communicating to the CDN, and the one-time cost of delivering content to the CDN servers.

40. On the other hand, content providers using CDNs must pay for the cost of locating servers at multiple locations close to connection points either directly—if they are setting up the CDN on their own—or through a fee to a third-party CDN, if they are outsourcing to a firm like Akamai or Limelight.

41. Ultimately, CDNs are not necessarily cheaper than transit, but they can offer some customers other advantages by providing a better quality connection for some traffic in terms of speed and accuracy of delivery.

IV. Comcast and TWC, Though Not Tier 1 Networks, Have Obtained Settlement-Free Peering

42. Some cable companies that provide broadband Internet access have been almost entirely successful in obtaining settlement-free peering from Tier 1 providers, while others pay for transit. The two largest cable companies, Comcast and TWC, both have settlement-free peering with Cogent even though, from looking at global routing tables, it appears as though they both purchase some level of transit from Tata. Other cable companies pay Cogent for transit. More recently, some large cable companies (like Comcast and TWC) are insisting on being paid by Tier 1 networks to peer with them.

A. Cable Companies Do Not Have Comparable Size to Tier 1 Networks

43. While Comcast and TWC have been able to obtain settlement-free peering from many ISPs, including Cogent, it is important to note that they are not Tier 1 ISPs. They do not provide the infrastructure and support for the Internet that Tier 1 providers do and they have transit agreements with other ISPs to reach parts of the Internet as seen in the global routing tables.

44. For example, while Comcast is the largest cable broadband provider in the United States, its network is substantially smaller than Cogent's, using standard measurements of the relative size of the two networks:

Metric	Cogent	Comcast
Traffic	100.4 petabytes/day	17.25 petabytes/day
Bit Miles	271 zettabytes/day	5 zettabytes/day
Routes (IPv4)	47,800	4,300
IP Address	10.56% of Internet	2.65% of Internet

45. This differential in metrics results from Comcast's focus on providing Internet to at-home consumers and businesses. Comcast has not created a broader network on par with Tier 1 networks. Instead, Comcast has a large number of subscribers with relatively small connections. By contrast, Cogent's customers typically require large connections.

B. Other Technologies Available to Residential Broadband Consumers Generally are Not Comparable to Cable Broadband Service

46. As the amount of data transmitted over the Internet increases, end-users increasingly expect to be able to access bandwidth-intensive and latency-sensitive applications such as streaming video and voice over internet protocol ("VoIP") calls. In 2006, when YouTube commenced operations, video still represented a relatively small percentage of overall Internet traffic. By 2009, video represented around 30% of Internet traffic,[2] and in 2013 it represented over 66% of Internet traffic.[3]

47. The broadband options available to at-home consumers who want to access bandwidth-intensive content have diminished as different technologies have proven to be inferior to cable. For those who have a choice of cable or DSL, cable is significantly superior. Fiber, which is another option, has not been widely deployed as of yet. Other options are either technologically insufficient, such as a telephone dial-up connection, or have failed to be successfully

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[2] Sandvine, *Global Internet Phenomena Spotlight, North America Fixed Access 1H 2012*, 1 (2012) *available at* https://www.sandvine.com/trends/global-internet-phenomena/.

[3] Cisco, *The Zettabyte Era: Trends and Analysis*, 2 (June 10, 2014) *available at http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/VNI_Hyperconnectivity_WP.pdf.*

implemented as a practical alternative to a home cable connection, such as satellite and mobile telephony.

48. Cable provides a connection through a mixture of coaxial and optical fiber cables. Download speeds can be as high as 500 megabits/second.

49. DSL provides a connection over the phone line using different bands of frequency for transmission of data than is used for wired telephone service. Download speeds are generally limited to approximately 7 Mbps. Although in certain parts of the country higher speed DSL options do exist, the availability of these faster DSL services is limited.

50. Fiber provides a connection through optical fiber run to each residence. Current offerings for fiber based consumer services can have upload and download speeds as high as 1 gigabyte/second. However, in order for fiber to become widely available, providers would need to run additional fiber lines to new homes. While AT&T, Verizon, and Google each have created some residential networks, AT&T and Verizon have not deployed this service on a network-wide scale, and both have suggested they do not plan to do so. Google has, to date, only a limited deployment of its fiber network.

51. Satellite provides data transmitted to the home from a geostationary satellite to a satellite dish mounted on a residence's property. Satellite is capable of delivering speeds up to 12 megabits per second, but latency is approximately twenty times worse than non-satellite services. Services such as VoIP require low latency connectivity to function properly and, therefore, satellite based connectivity is not generally considered an option for many users.

52. On one of the new 4G networks, mobile devices are theoretically capable of attaining speeds as high as 300 megabits per second. In practice, download speeds are much slower. Additionally, the cost of the service is significantly higher, with data caps that effectively discourage downloading bandwidth-intensive media.

53. As a result of the limited options for broadband Internet connections, most residential consumers generally have only two options—cable and DSL—and, as explained, cable generally has superior connection speeds compared to DSL.

IV. Examples of Cogent's Recent Dealings With Comcast

54. Cogent has experienced recent dealings with Comcast that are relevant to the issues presented by the pending transaction. The first involves Comcast's position that the so-called imbalanced ratio of traffic exchanged between Cogent and Comcast should affect the Cogent/Comcast peering arrangement. The second involves the congestion created at interconnection points between Cogent and Comcast during the period following Netflix' commencement as a Cogent customer. I discuss each in turn below.

A. Comcast's "Balanced Traffic Ratio" Requirement Makes No Sense

55. Comcast has taken the position that it is entitled to payment for Internet connections with other Internet participants because of the imbalance between the Internet traffic Comcast's subscribers receive and the Internet traffic Comcast's subscribers transmit to the Internet.

56. As I noted when describing peering negotiations between Tier 1 providers, one criteria that certain entities have included in peering agreements is that there be a relatively equitable traffic ratio between the two entities, i.e. that roughly the same amount of traffic be sent from one network to the other. Cogent does not believe this is an appropriate criterion for deciding whether to agree to settlement-free peering in the context of Tier 1 negotiations. More importantly for present purposes, it makes no sense to apply it to peering agreements between a Tier 1 backbone and a cable broadband provider for several reasons.

57. First, cable broadband providers have designed their networks to be asymmetric—i.e. cable customers can download more than they upload. Thus, by their own design, broadband cable companies seem to assume that their customers will at least on average receive more Internet traffic than they transmit. This design is no accident. Access to the Internet for home users has proven to be an asymmetric experience—users want to download more content than they upload. It is therefore impractical for any broadband ISP to expect to have balanced traffic.

58. Second, the premise of Comcast's position is that the additional download traffic it receives is somehow forced upon it. That is not accurate. The Internet content that Cogent delivers to Comcast's network is traffic that is requested by Comcast's paying customers.

59. Third, the path Internet traffic takes is routed according to that network's defined rules, but returning traffic will prefer the return path with the fewest autonomous systems. The network with the most connections will have the most traffic come back through it. Thus, a Tier 1 backbone provider will always deliver more traffic to a cable ISP than the cable ISP will transmit to a Tier 1 provider. This has been the default behavior of BGP routing since its inception in 1989.

60. There is no valid reason for Comcast to claim that an imbalanced traffic ratio is inequitable or unanticipated. The cable companies' entire ISP model is based on providing content to at-home users and is not designed to transmit data. Many of these companies prohibit customers running their own servers.

B. Comcast Has Refused Sufficient and Timely Upgrades to Connections with Cogent Which Creates Congestion

61. Throughout last year, Comcast appeared to deliberately fail to augment port capacity in a manner that created congestion at interconnection points between Cogent and Comcast.

62. As I noted when I described peering arrangements, a common understanding is that both parties will add capacity when current connections are operating at around 70% capacity. Prior to Cogent taking on Netflix as a customer, Comcast had a history of augmenting ports that was consistent with this approach. After Cogent began delivering Netflix content, Comcast initially upgraded five of the connections by adding new ports. Then it elected not to upgrade additional connections as they filled up beyond the 70% range.

63. Under normal working conditions, settlement-free peers negotiate and support each other's network changes, such as location moves and capacity augments, to address the changing nature of the industry in addition to the more obvious traffic growth. In the first half of 2013,

Cogent supported Comcast's desire to relocate peering facilities in a few locations and while doing so, a small amount of additional capacity was added. During this time, congestion was continuing to grow as were customer complaints. Repeated attempts to discuss adding capacity with Comcast were completely rebuffed.

64. On June 14, 2013, having not been able to relieve congestion at interconnection ports with Comcast, Cogent's General Counsel sent a letter to the General Counsel of Comcast. A copy of that letter is attached hereto as Exhibit 1. Comcast's June 20, 2013 response (attached as Exhibit 2) stated in part:

> We would be happy to discuss ways to groom the traffic arrangement between us so that the relationship can return to a more balanced state—which is the normal course in such situations. Alternately, if Cogent needs new levels of capacity, above and beyond what our mutually beneficial arrangement is designed to handle, we are happy to discuss a commercial arrangement for incremental ports.

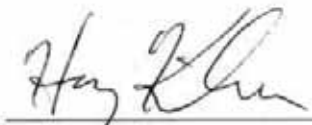
65. Cogent understood this response to mean that Comcast would not upgrade capacity without Cogent either (1) reducing the amount of traffic delivered to Comcast's network (a significant and then-growing part of which was attributable to Netflix)[4] or (2) agreeing to a paid peering arrangement.

66. Not willing to acquiesce to either demand, Cogent attempted to re-route traffic to other interconnection points where it connects to Comcast. However, as Comcast continued to neglect necessary upgrades to Cogent's interconnections with Comcast, virtually all of Cogent's connections became congested during peak hours.

67. 2013 port traffic data shows that there were many months where some ports operated at capacity for long periods of the day. As Cogent's connections with Comcast became congested, content requiring more bandwidth, such as streaming video and VoIP calls, began to experience packet loss as it was transferred to Comcast. The effect was that Netflix customers in particular began to experience significantly degraded video from Netflix; however, that was not the only effect because packet loss affects everything over the connection. For example, Cogent business customers whose employees used Comcast as their residential ISP had difficulty connecting to their corporate networks from home. Likewise, certain edge provider customers experienced impediments to transmitting data to Comcast users via Cogent.

68. It is important to note that Comcast allowed the congestion to proceed despite the fact that its customers were clearly harmed. The congestion particularly impacted video streaming and VoIP calls, but it affected all traffic Cogent delivered to Comcast's customers. Further, an upgrade would be easy to execute and not particularly expensive. As I have already noted, upgrading a connection has a relatively minimal cost. The cost of upgrading all of the connections between Comcast and Cogent, completely resolving these concerns, would have been approximately $120,000. In fact, in March of 2014 Cogent offered to pay for Comcast's expenses in upgrading the connections with Cogent. Comcast refused.

[4] Cogent has delivered Netflix traffic to, among others, AT&T, Charter, Comcast, TWC, and Verizon.



Henry Kilmer
Vice President of IP Engineering
Cogent Communications Holdings, Inc.

EXHIBIT 1

Kilmer Declaration

cogent COMMUNICATIONS

Optical Internet

Brilliantly Fast. Elegantly Simple.

www.cogentco.com

Robert N. Beury Jr.
Chief Legal Officer
Cogent Communications Group, Inc.
1015 31st Street, NW
Washington, DC 20007
rbeury@cogentco.com
1-202-295-4254

June 14, 2013

Arthur R. Block
Senior Vice President & General Counsel
Comcast Corporation
Comcast Center
1701 JFK Boulevard
Philadelphia, PA 19103

Internet Peering with Cogent Communications

Dear Mr. Block:

Comcast has refused to increase the capacity of the Internet connections between Cogent and Comcast. That refusal violates sections V(G)(1) and V(G)(5) of the NBC Universal consent decree.

Section G(5) states: "Comcast shall offer Internet Access Service that is sufficiently provisioned to ensure, in DOCSIS 3.0 or better markets, that an Internet Access Service subscriber can typically achieve download speeds of at least 12 megabits per second." By refusing to increase the capacity of connections to Cogent Comcast has failed to sufficiently provision its Internet Access Service. The packet loss that results when the connections are overwhelmed prevents a Comcast subscriber from achieving a download speed of 12 megabits per second when accessing a customer of Cogent. This problem presents itself most seriously when Comcast customers are attempting to view movies and television over the Internet.

Comcast's refusal to increase capacity also violates section V(G)(1) of the consent decree which states: "Comcast, insofar as it is engaged in the provision of Internet Access Service, shall not unreasonably discriminate in transmitting lawful network traffic over a consumer's Internet Access Service." Comcast's refusal to increase connection capacity discriminates against Internet traffic arriving from or destined for Cogent's customers compared to Internet traffic arriving from or destined for Comcast's own Internet customers.

Please correct this situation. Our customers and your customers are receiving lower quality service because of it.

Yours truly,

Robert N. Beury Jr.
Chief Legal Officer
Cogent Communications Group, Inc.

EXHIBIT 2

Kilmer Declaration

Arthur R. Block
Senior Vice President
General Counsel and Secretary

June 20, 2013

Robert N. Beury, Jr.
Chief Legal Officer
Cogent Communications Group, Inc.
1015 31st Street, NW
Washington, DC 20007

Dear Mr. Beury:

I was surprised to receive your June 14, 2013 letter suggesting that Comcast is refusing "to increase the capacity of the Internet connections between Cogent and Comcast." That statement does not reflect our repeatedly stated willingness to work together to address our companies' traffic exchange needs.

For over 5 years, our companies have had a settlement-free Internet backbone interconnect arrangement, consistent with industry norm, without incident or dispute. That successful arrangement has resulted in large part from cooperative capacity planning that has ensured that the backbone connection is sufficient to meet both parties' foreseeable traffic needs and provides mutual benefit (and imposes largely equivalent costs) on both parties.

Pursuant to that collaborative process, Cogent informed us in the fall of 2012 that you had sufficient capacity for your foreseeable needs for 2013, and based on our own outgoing traffic needs, we agreed that our backbone interconnect facilities did not need to be augmented. It appears that your forecasts were underestimated, and that you subsequently chose to sell Comcast-directed transit service to customers in amounts that far exceed what our mutual interconnect was designed to carry. Notwithstanding that this additional traffic load has significantly strained the notion of the "balanced" relationship that we have had for half a decade, we have accommodated your suddenly increased needs over the course of this year, adding 50 Gigabits of incremental capacity in the first few months of 2013. Notably, we did that on a settlement-free basis out of respect for our longstanding relationship – even though the growing traffic imbalance has eroded the mutual benefit assumption that underlies both our settlement-free arrangement and international practice relating to settlement-free peering.

We would be happy to discuss ways to groom the traffic arrangement between us so that the relationship can return to a more balanced state – which is the normal course in such situations. Alternatively, if Cogent needs new levels of capacity, above and beyond what our mutually beneficial arrangement is designed to handle, we are happy to discuss a commercial arrangement for incremental ports. I believe the offer to discuss either or both of these options has been made at the business level, and it would seem beneficial to both companies – and far more consistent with the longstanding settled working relationship we have enjoyed – to pursue those discussions before resorting to legal letters and allegations.

One Comcast Center Philadelphia, PA 19103 www.comcastcorporation.com
Office: 215 286 7564 Email: ablock@comcast.com

That is especially so given that the allegations in your letter are meritless. The *NBCUniversal* consent decree does not dictate the commercial terms of our backbone peering relationships. Section G(5) of the consent decree requires that we provide 12 Mbps download speeds to Comcast's residential customers. Not only have we met that obligation, but, by March of this year, we also had increased our 12 Mbps Performance broadband service tier to 20 Mbps service across our entire service area. And the FCC has recognized that Comcast on average *exceeds* our advertised speeds. http://www.fcc.gov/measuring-broadband-america/2013/February#Year_By_Year. While we cannot ensure that sending parties send their files to our customers at 12 Mbps, or that other service providers will use responsible arrangements or high quality transit links to transmit *their* customers' content, on our end, our customers most certainly can and do "typically achieve download speeds of 12 megabits per second."

As for your reference to section V(G)(1) of the consent decree, Comcast transmits Cogent's (and all other entities') traffic to (and from) our customers on a nondiscriminatory basis. And in all events, as the Open Internet Order and former Chairman Genachowski both made clear, those rules – which are the basis for the consent decree requirement – do not apply to or dictate providers' backbone peering arrangements. *See* Open Internet Order, ¶ 67 n. 209; Cecilia Kang, *FCC Defends Net Neutrality to Lawmakers, Says Level 3-Comcast Not Covered by Rules*, Washington Post, Feb. 17, 2011, *at* http://voices.washingtonpost.com/posttech/2011/02/fcc_defends_net_neutrality_to.html.

In short, the legal accusations are a diversion from the commercial issue before us. We are long-term peering partners, and it is in our mutual interest to ensure that traffic flows unimpeded between our networks. If your needs have grown beyond the limits of our mutually beneficial arrangement given your recently increased transit business, we are committed to working with you on a commercial solution to provision the incremental capacity you need. We should be able to do that expeditiously. Please have your business team reach out to ours, and we can proceed with those discussions as promptly as possible.

Sincerely,

Arthur R. Block
Senior Vice President, General Counsel
and Secretary

ARB/aml