January 23, 2015

BY ECFS

Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street NW
Washington, DC 20554

Re: Applications of Comcast Corp. and Time Warner Cable Inc. for Consent to Assign or Transfer Control of Licenses and Authorizations, Docket No. 14-57

Dear Ms. Dortch:

Pursuant to the Second Amended Modified Joint Protective Order, Netflix submits the redacted version of its highly confidential narrative response to the Commission’s request for additional information regarding the analysis performed by Dr. David Evans in his Declaration filed with Netflix’s Reply on December 23, 2014. The highly confidential documents and information Netflix filed with the Commission in response to this request are redacted in their entirety.

Netflix is continuing to work diligently to produce additional documents and information responsive to the request for information to Netflix dated December 19, 2014.

---

1 Applications of Comcast Corp. and Time Warner Cable Inc. for Consent to Assign or Transfer Control of Licenses and Authorizations, Docket No. 14-57, Second Amended Modified Joint Protective Order, DA 14-1639 (Nov. 12, 2014) (“Modified Joint Protective Order”).
Please contact me with any questions.

Respectfully submitted,

Markham C. Erickson
Counsel for Netflix, Inc.

Enclosures
Response to FCC Requests Regarding Evans Declaration II

I. Netflix Bitrate Changes for Comcast Customers (¶ 10)

About {{ }}. More precisely, {{ }}

The distribution of Comcast accounts by the size of changes in average bitrates over this period are shown in more detail below.

Distribution of Accounts by Bitrate Change

{{ }}

II. Share of Netflix Hours Streamed Using a Mobile Wireless ISP (¶ 88)

About {{ }} of Netflix hours are streamed using a mobile wireless ISP. This estimate by Netflix is based on U.S. viewing hours in May 2014, the most recent available month around the time the estimate was provided. It includes all U.S. hours streamed using a mobile wireless ISP. It includes all hours viewed by any subscriber using a mobile wireless ISP even if the subscriber uses wired ISPs for some, much or virtually all of his or her Netflix viewing.

III. Comcast and Charter Average Bitrates (¶¶ 102-104)

See the attached programs and datasets. For a detailed discussion of the data and the programs, see the attached white paper:

The average bitrate by ISP for the pre-degradation and nadir periods are reported in the output file “bitrate_by_isp_period_final.csv”, which is created by the program “9-bitrate-by-isp-period.sas”.

The average bitrate by ISP and week are reported in the output file “bitrate_by_isp_week_final.csv”, which is also created by the program “bitrate_by_isp_period.sas”.

For context, here are the approximate qualities associated with each bitrate.

- 500 Kbps is roughly the speed needed for stream with the quality of a VHS tape;
- 1750 Kbps is roughly the speed needed for stream with the quality of a DVD;
- 2350 Kbps is roughly the speed needed for stream with the quality of a 720p broadcast;
- 5000 Kbps is roughly the speed needed for stream with the quality of a 1080p broadcast; and,
- 8000 Kbps is roughly the speed needed for stream with the quality of a 4K broadcast (Ultra HD).

Since peak bitrates for a stream of a given quality will be higher than the average bitrate for that stream, Netflix recommends that consumers have an Internet connection with speeds well above the average speed for the quality they desire, e.g., 3000 Kbps for a stream with 720p quality and 5000 Kbps for stream with 1080p quality. The company advises potential customers that they should have an Internet connection of at least 500 Kbps and preferably 1500 Kbps or higher. See https://help.netflix.com/en/node/306.

The differences-in-differences regressions are performed by the program “6 – Main Results by Billing Zip – Charter.do”.

We have one correction to report. In the declaration, it was stated that “Between the last week of October 2013 and the last week of December 2013 the average weekly bitrate fell {{ }} for Comcast customers and rose {{ }} for Charter customers.” The {{ }} decline for Comcast customers is correct, but the {{ }} increase for Charter customers should be a {{ }} increase. These results are reflected in the code provided.

IV. Interconnection Fee Tobit Regression (¶ 139)

See the attached dataset and programs. The interconnection fee Tobit regression is performed by the program “interconnection-pricing.do”.

V. Estimates of Netflix’s Costs of Delivering Traffic (¶¶ 219-222)

We have the following estimates of costs for Netflix of delivering content to subscribers:
ISPs with embedded Netflix servers. More than {{ }} ISPs interconnect with Netflix using Open Connect appliances that are “embedded” within the ISP’s network. None of these ISPs charges a terminating access fee. In this case Netflix’s costs of serving traffic to a large ISP using this approach are about {{ }} per Mbps. This represents the costs Netflix needs to incur in order to deliver traffic to an ISP within the ISP's network using Open Connect appliances. The {{ }} per Mbps estimate consists of an estimated {{ }} per Mbps of hardware costs, {{ }} per Mbps of CDN headcount costs, and {{ }} per Mbps of estimated allocation of general and administrative expenses.

The hardware costs are estimated based on the costs of serving traffic to {{ }}, which uses embedded Open Connect appliances. Approximately {{ }} embedded cache servers costing approximately {{ }} each are used to serve {{ }}. An additional 4 PCs costing approximately {{ }} each are used for maintenance services in connection with the embedded cache servers. Allocating these expenses on a straight line basis assuming a 36 month useful life results in an estimated monthly expense of {{ }}. Dividing {{ }} by the estimated 95th percentile traffic served of about {{ }} (based on July 2014 traffic) results in the {{ }} per Mbps of hardware costs. The cost per Mbps of cache servers generally decreases as ISP size increases. Netflix’s costs for larger ISPs would likely be at or below the cost for {{ }}; Netflix’s costs for smaller ISPs would be significantly higher.

The {{ }} per Mbps of CDN headcount costs is based on Netflix’s costs for its networking team, which were about {{ }} as of mid-2014. These costs include compensation (including stock compensation), benefits, and allocations for office space and facilities (but not allocations of overhead functions of the company, such as for headcount associated with management, finance or human resources). If we allocate these costs to U.S. operations based on the approximately {{ }} percent ratio of U.S. to global Netflix traffic (as of the end of August 2014), these costs are about {{ }} on a monthly basis. We obtain an estimate Netflix U.S. 95th percentile traffic of about {{ }} by dividing the approximately {{ }} of Netflix U.S. peak traffic (in August 2014) by 1.2, a ratio that Netflix uses to estimate 95th percentile usage based on peak usage. Dividing the {{ }} monthly costs by the {{ }} estimate of 95th percentile traffic results in an estimate of about {{ }} per Mbps.

The {{ }} per Mbps of estimated allocation of general and administrative expenses is based on the estimated proportion of such expenses to other firms with CDN operations. A third-party CDN incurs expenses for general and administrative expenses in addition to its operating headcount costs. We have used the ratio of general and administrative expenses to operating headcount expenses for {{ }} (based on their 10-Ks reporting data for the year ending December 2013) to provide an estimate of the general and administrative expenses that might be allocated to Netflix’s CDN costs. The ratio of general and administrative expenses to total operating headcount expenses (including R&D costs as well as personnel costs because the {{ }} in Netflix headcount costs noted above includes personnel engaged in R&D) was {{ }}. We take the average of the two ratios and multiply the average with the previously estimated {{ }} per Mbps in Netflix
headcount costs, resulting in a rough estimate of {{ } per Mbps for general and administrative costs.

Because Netflix does not provide CDN services to third parties, it does not incur certain other costs that some third-party CDNs would incur, such as sales and marketing expenses. Third-party CDNs would need to cover such costs in their fees and would need in the long run to cover the cost of capital invested. A full comparison between a self-supplied CDN and a third-party CDN would need to account for these types of differences.

**ISPs that connect with Netflix at IXP.** More than {{ }} ISPs interconnect with Netflix at an IXP or other public interconnection point. With the exception of the four largest ISPs, none of them charge a terminating access fee. Netflix’s costs of serving traffic using this approach to an ISP that is not charging a terminating access fee are about {{ }} per Mbps. This represents the costs Netflix needs to incur in order to deliver traffic to an ISP at an IXP.

The {{ }} per Mbps estimate consists of {{ }} per Mbps of IXP costs, {{ }} per Mbps of CDN headcount costs, and {{ }} per Mbps of estimated allocation of general and administrative expenses.

The {{ }} per Mbps of IXP costs is based on Netflix’s costs of operating at IXPs. These costs include the amortized costs of cache boxes ({{ }} per Mbps); amortized costs of routers ({{ }} per Mbps); other hardware that is expensed and calculated for these purposes on a 12 month rolling basis ({{ }} per Mbps); co-location expenses ({{ }} per Mbps); and payments to third-party vendors for services such as on-site assistance and troubleshooting ({{ }} per Mbps). These estimates are for August 2014 and are for all IXPs located in the United States. These IXPs also serve a small proportion of traffic to ISPs in Canada and Latin America (on the order of {{ }}). These estimates are based on all costs incurred at these IXPs and all traffic served by these IXPs.

The {{ }} per Mbps of CDN headcount costs and {{ }} per Mbps of estimated allocation of general and administrative expenses are calculated as described above for traffic served using embedded Open Connect appliances. As noted above, because Netflix does not provide CDN services to third parties, it does not incur certain costs that some third-party CDNs would incur, such as sales and marketing expenses. Third-party CDNs would need to cover such costs in their fees and would need in the long run to cover the cost of capital invested. A full comparison between a self-supplied CDN and a third-party CDN would need to account for these types of differences.

**Netflix’s costs of serving traffic to Comcast under the Comcast agreement.** Netflix’s costs of serving traffic to Comcast using this approach is approximately {{ }} per Mbps. This consists of the same {{ }} per Mbps costs incurred by Netflix to exchange traffic at an IXP as with other ISPs but, in addition, Netflix must pay a {{ }} per Mbps terminating access fee imposed by Comcast.

The monthly payment made by Netflix to Comcast is based on Netflix’s contract with Comcast and equals the annual payment of {{ }} divided by 12, or {{ }}.
For a measure of traffic usage for Comcast, we used actual data on its peak usage in August 2014 of {{ }}, divided by 1.2, a ratio that Netflix uses to estimate 95th percentile usage based on peak usage, to obtain an estimate of 95th percentile usage of {{ }}. The {{ }} per Mbps access is calculated by dividing the dollar access fee by the traffic estimate.

**ISPs that connect with Netflix using a transit provider.** More than {{ }} ISPs interconnect with Netflix using a transit provider. Netflix connects to the transit provider at an IXP and the transit provider takes the traffic to another interconnection point closer to the ISP. The ISPs served using this approach are typically smaller ISPs that do not have a presence at an IXP. Netflix’s costs of serving traffic to a small ISP using this approach are about {{ }} per Mbps. This consists of {{ }} per Mbps in costs incurred by Netflix to exchange traffic at an IXP with the transit provider plus an approximate {{ }} per Mbps in fees paid to the transit provider.

The {{ }} per Mbps in costs incurred by Netflix to exchange traffic at an IXP with a transit provider is calculated in the same way as for the costs incurred by Netflix to exchange traffic at an IXP with an ISP, described above.

The cost of paying a transit provider to take traffic from the IXP to another interconnection point closer to a small ISP can vary. The {{ }} per Mbps of such costs is a rough estimate of what such costs were around August 2014. It is not an exact calculation.
NFX-FCC-00000001

Redacted in its entirety.
NFX-FCC-00000063

Redacted in its entirety.
REDACTED – FOR PUBLIC INSPECTION

NFX-FCC-00000064

Redacted in its entirety.
NFX-FCC-00000066

Redacted in its entirety.
NFX-FCC-00000067

Redacted in its entirety.