



# **Campus/Regional Video Traffic**

**General Comments**

**Netflix Open Connect**

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# Video on Campus – Vertical growth

## Overview

1. Traditional Cable over coax - Comcast
2. Internet Cable – Tivli.com
3. Netflix – Apple TV, Roku, Sling Box, SmartTV's
4. Youtube, Hulu, Amazon, HBO, ESPN, too many CP's to mention
5. Course Capture and Streaming
6. Live Broadcasting of events
7. Specialized Networks required for live editing and storage of video
8. Video Conferencing – Desktop, Room Based, Mobile (Impact on Wireless)
9. Video Surveillance Systems – Storage..
10. Video Signage – Content, Forms, Storage
11. DMCA Notices with all of the above are down...



# A focus on Netflix Internet2, Northern Crossroads, Harvard

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## Impact of video on Regional Networks:

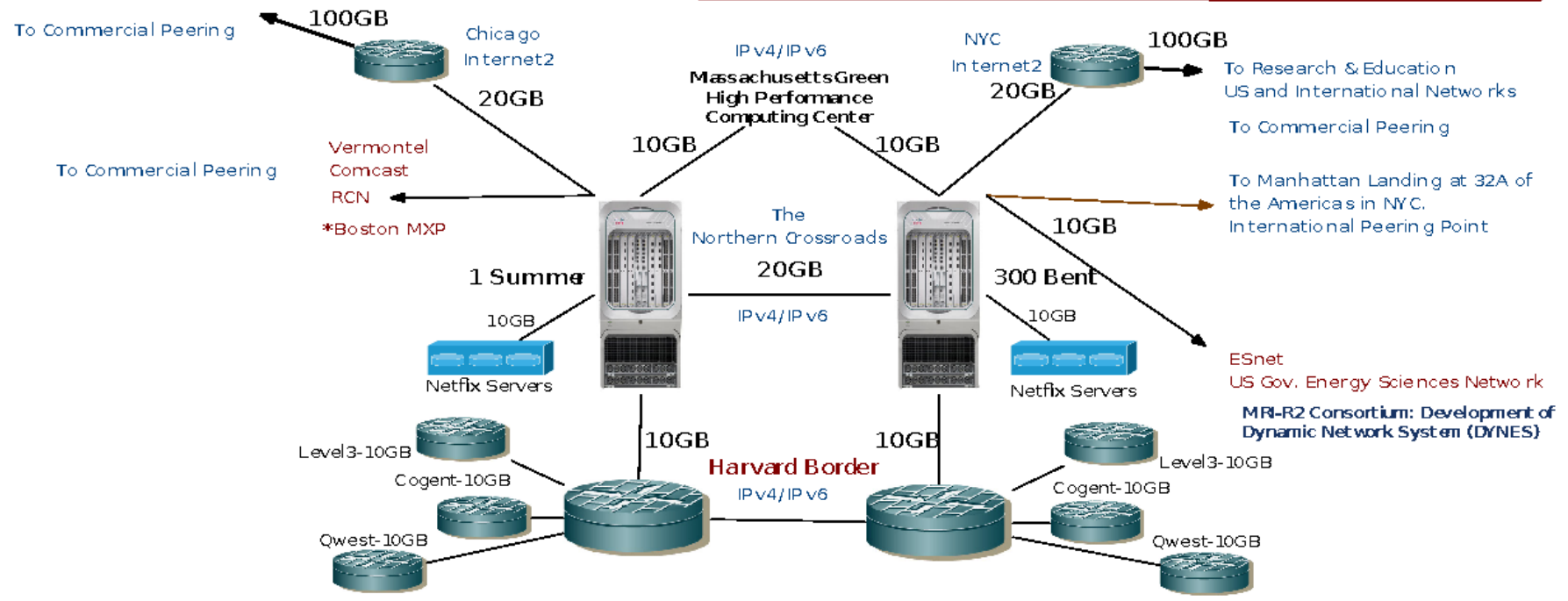
1. Significant traffic (10GB plus) into the New England area via the NoX and I2 CPS service.
2. Netflix traffic destined for campus residential dorms a significant portion of that traffic
3. We noticed immediately when I2 made some peering changes and saw significant traffic shift from Chicago to NYC
4. We reached out to Netflix and worked with them to install caches at the Northern Crossroads
5. Have to meet peering criteria and we did. Netflix very helpful and supportive during startup and providing data for this presentation.
6. Harvard alone at 600MB's of netflix traffic, expected to grow quickly to 1GB's
7. Netflix Open Connect Content Delivery Network <https://signup.netflix.com/openconnect>

# Netflix Caches – BGP Peering/AS Announcements

**More than half of Global Routing Table with Internet2 and Local Peering  
250,000 plus routes**

**Harvard Commercial and Research Peering**

\*Pending





# Netflix Cache Offload Figures

Cache offload figures for a busy night (looks like Mondays have more traffic than Sundays, which is typically the peak day).

Over 80% offload from two caches is quite good.

4/15/13	8:00 PM	Embedded	7.828	81.13%
4/15/13	8:00 PM	IX	1.184	12.27%
4/15/13	8:00 PM	CDN	0.637	6.60%

Embedded = the appliances in our network

IX = clusters of appliances located at peering points/Internet Exchanges

CDN = Akamai, LimeLight, Level3

For the past 30 days the average stream bit rate was 2108Kbps

For the 30 days prior to that it was 2114Kbps

Again, these are good numbers.

Visualization of a few metrics:

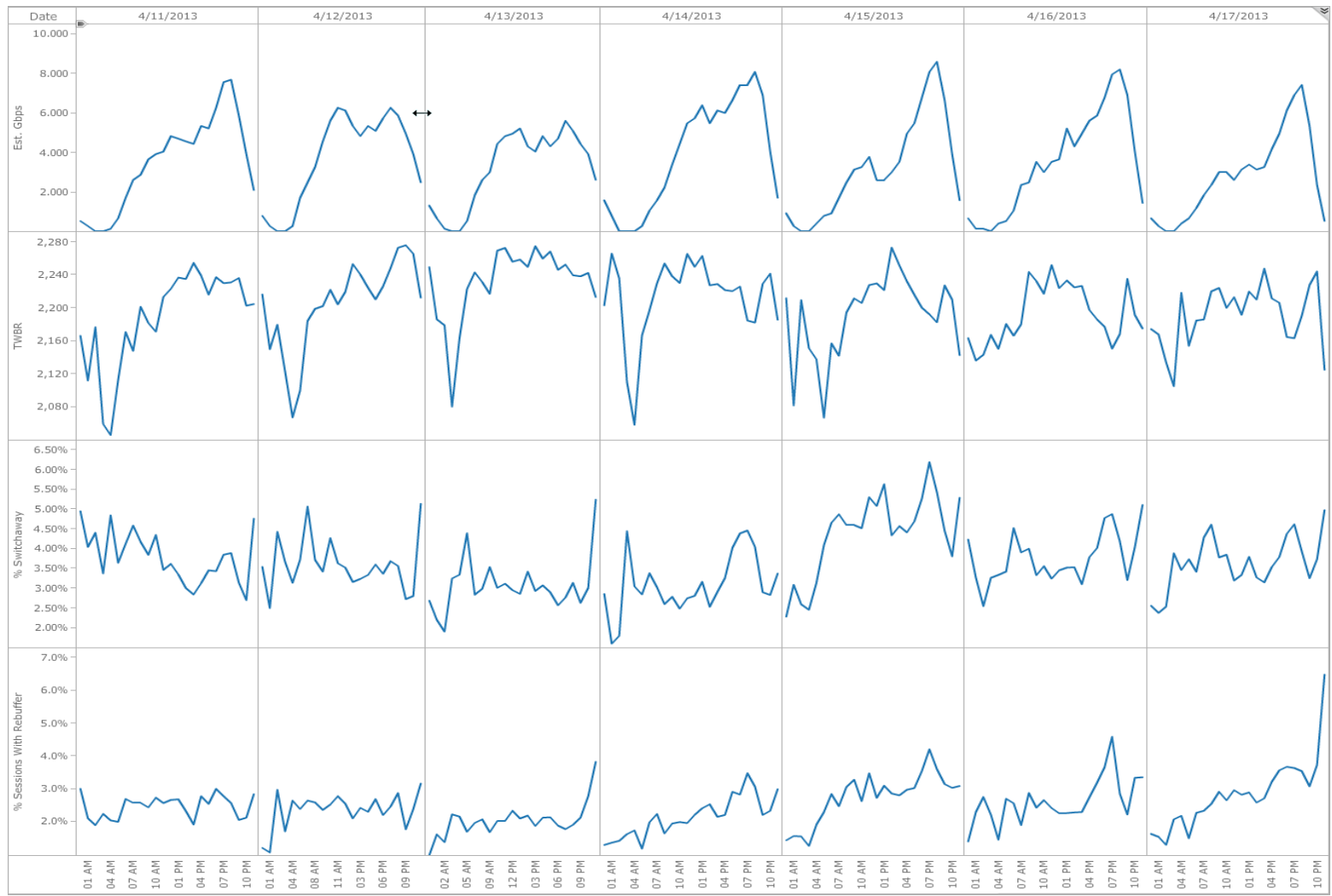
Est. Gbps - Basically throughput

TWBR - Time Weighted Bit Rate, aka Average Streaming Bit Rate

%Switchaways - % of Sessions which jumped to another cache to stream

%Sessions with Rebuffers - Rebuffers are the pauses in playback

# Netflix – Details NoX as a region



**8-9 GB's**

**BitRate  
Avg 2108**

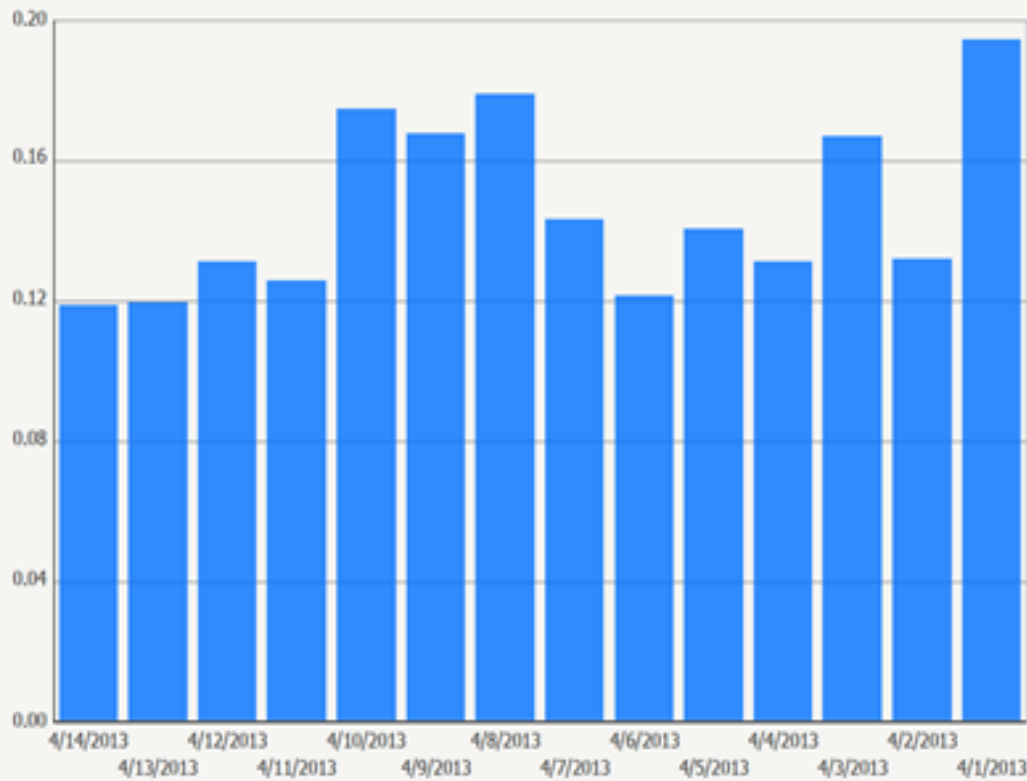
**Switchaway's**

**Rebuffers  
Pause in Playback  
<3% on Avg**

# NoX – Netflix Caches - Rebuffers

NOX Average Rebuffers per Session Hour

NOX Average Rebuffers per Session Hour

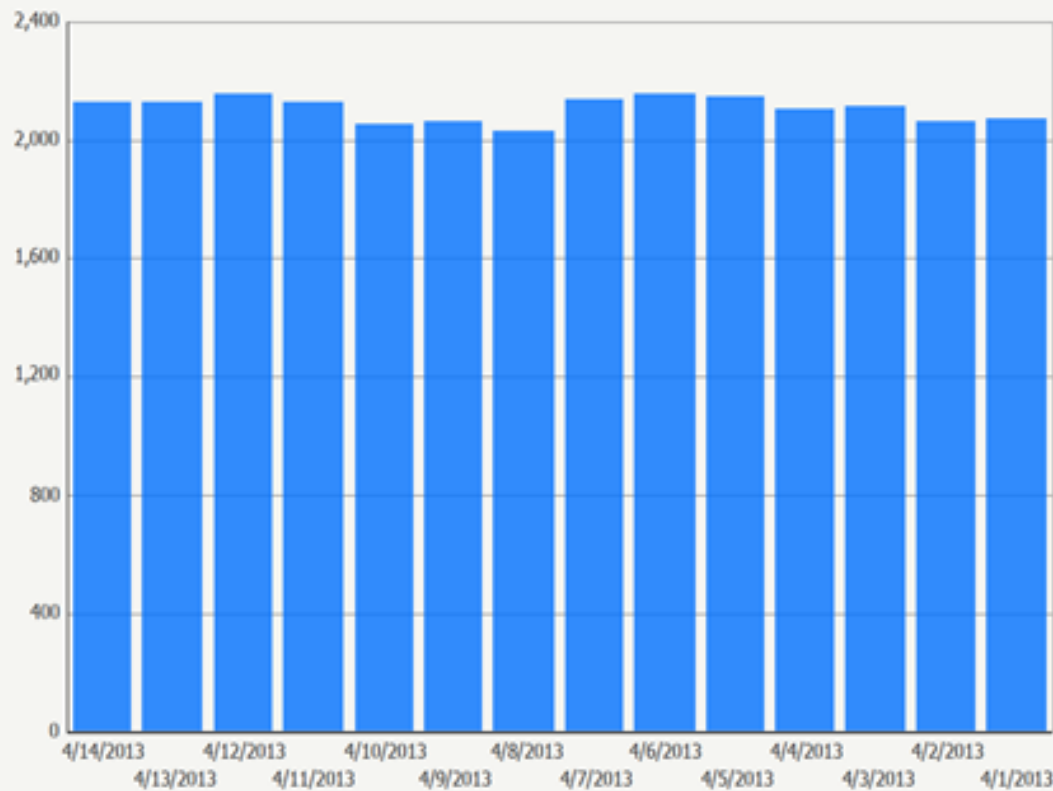


Date	Metrics	Avg Rebuffers per Session Hour
4/14/2013		0.12
4/13/2013		0.12
4/12/2013		0.13
4/11/2013		0.13
4/10/2013		0.17
4/9/2013		0.17
4/8/2013		0.18
4/7/2013		0.14
4/6/2013		0.12
4/5/2013		0.14
4/4/2013		0.13
4/3/2013		0.17
4/2/2013		0.13
4/1/2013		0.19

# NoX – Netflix Caches – Average Bit Rate

NOX Average Bit Rate

NOX Average Bit Rate



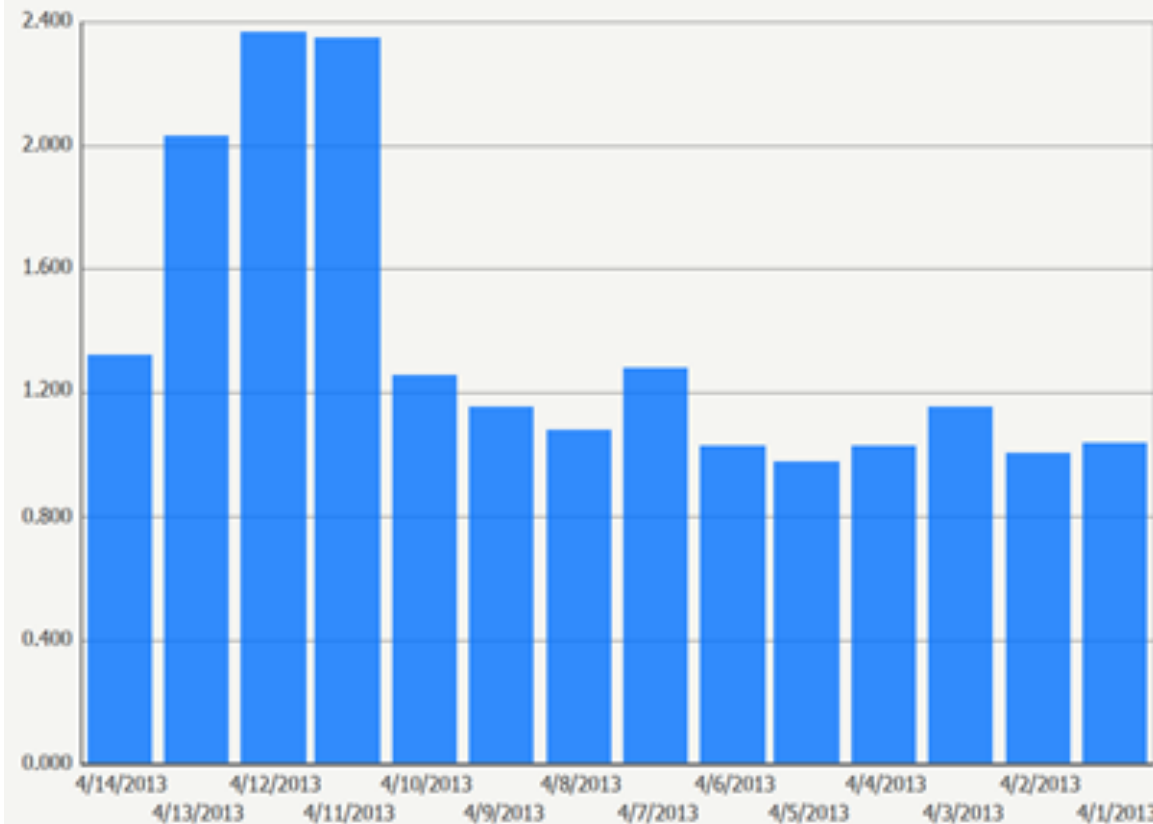
Date	Metrics	Avg Bit Rate - Time Weighted
4/14/2013		2,126
4/13/2013		2,129
4/12/2013		2,153
4/11/2013		2,124
4/10/2013		2,055
4/9/2013		2,060
4/8/2013		2,037
4/7/2013		2,133
4/6/2013		2,155
4/5/2013		2,152
4/4/2013		2,109
4/3/2013		2,115
4/2/2013		2,068
4/1/2013		2,078



# NoX Peak Throughput

NOX Peak Throughput

NOX Peak Throughput



■ Est. Peak Throughput (Gbps)

Date	Metrics	Est. Peak Throughput (Gbps)
4/14/2013		1.320
4/13/2013		2.034
4/12/2013		2.367
4/11/2013		2.343
4/10/2013		1.254
4/9/2013		1.154
4/8/2013		1.078
4/7/2013		1.284
4/6/2013		1.033
4/5/2013		0.980
4/4/2013		1.025
4/3/2013		1.153
4/2/2013		1.011
4/1/2013		1.037