Netflix Open Connect

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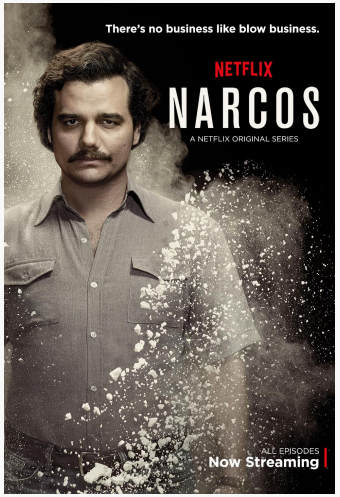
Netflix Update

Background

- Deliver content to over 190 countries
- 450 million potential broadband households
- 83 million global members as of July 2016
- Over 1 billion hours of streaming per month



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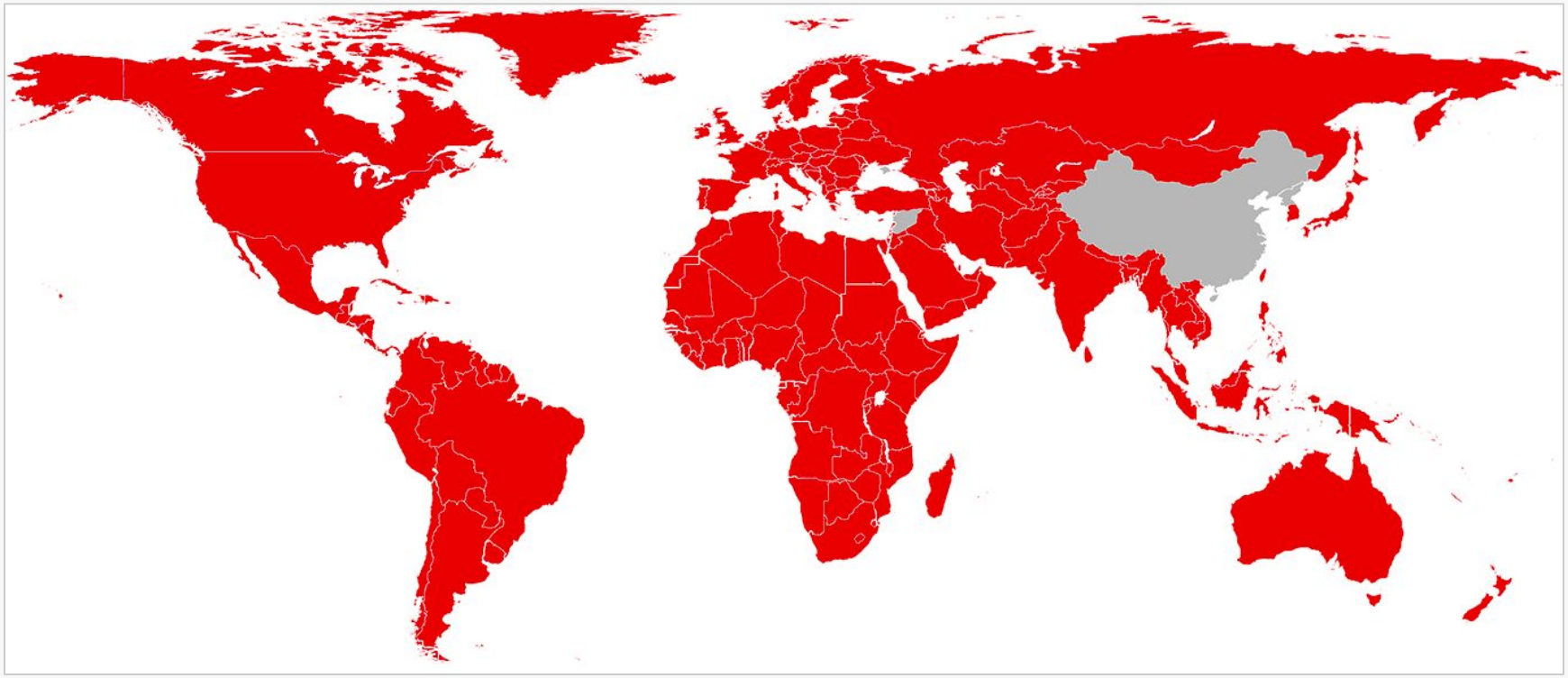
Netflix Markets



Where is Netflix Available?

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Netflix Original Content

- Netflix Original Premier Dates

- **Highlights of Recent and Planned Releases**
  - All Available in 4k resolution
  - **A Series of Unfortunate Events** - January 13 2017
  - **Chef's Table Season 3** - February 17 2017
  - **House of Cards Season 5** - 2017
  - **Bloodline Season 3** - 2017
  - **Orange is the New Black Season 5** - 2017

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Netflix Open Connect

Mission

Enable Internet Service Providers to provide a great Netflix experience

How?

- ISPs can Embed Netflix Open Connect Appliances (OCAs) at no cost
- Peering at over 50 public internet exchange points
- Private interconnection at 60+ global locations using 10G and 100G

Impact

- Transit savings by moving traffic to SFI or local embedded OCAs
- Lower operational expenses by removing traffic from aggregation links
- Lower capital expenditures via deep network deployments
- Dual-Stack IPv4 and IPv6 to support developing architectures

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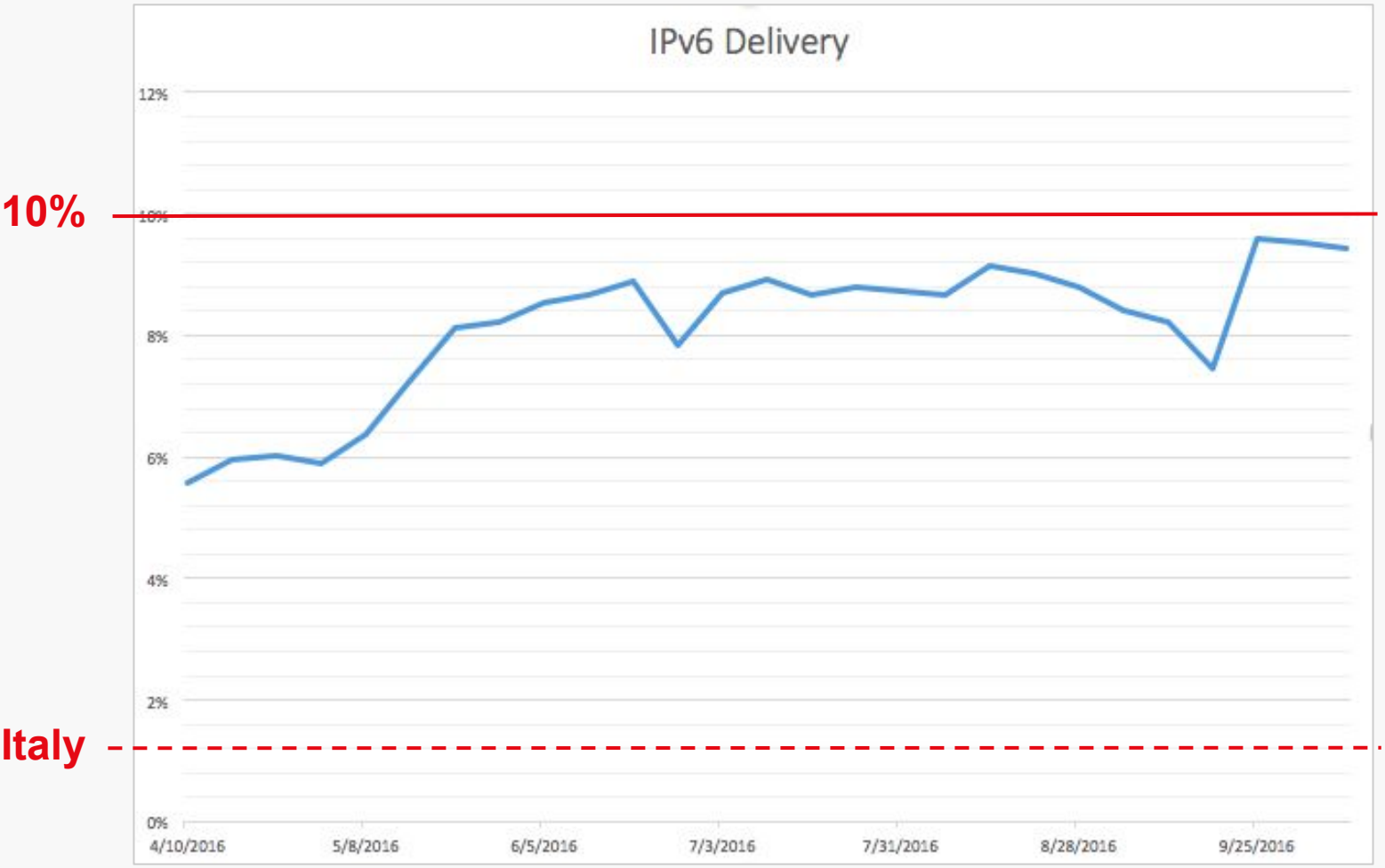
ISP Partner Impact - IPv6



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ISP Partner Impact - Algorithm Optimization

- **Bandwidth-Optimized User Experience**
  - CBE anounced in December 2015: http://techblog.netflix.com/2015/12/per-title-encode-optimization.html
  - Per-scene transcoding optimization based on on video signal analysis
  - Minimize bandwidth while maximizing video quality
    - Some sections of titles have increased short-term bitrates
- **Streaming Algorithm Excellence**
  - Continually adapt streaming to each user's network conditions
  - Best quality at the lowest bitrate possible for a given user device
- **No Wasted Bits**
  - Continually iterate on localization efficiency
  - Optimize for each consumer device platform

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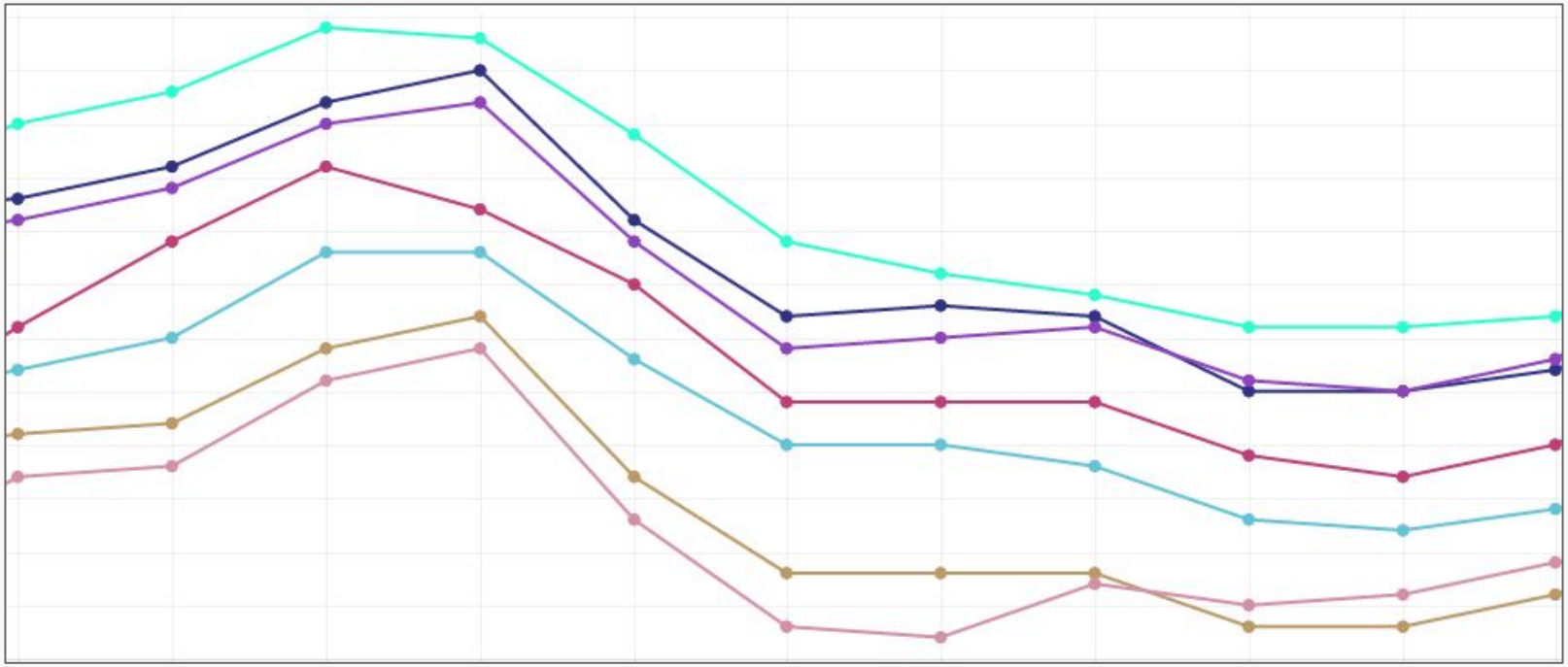
ISP Partner Impact - Speed Index



October 2015 to August 2016

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Open Connect Appliances (OCA)

- Custom architecture for each ISP to optimize offload
- Up to 100% of Netflix content served from within ISP network
  - Reduces or eliminates Netflix traffic from upstream links during peak hours
  - Removes edge network congestion which can lead to improved performance
  - Offload percentage based on scale of deployment
- Content replenishment during off-peak hours (e.g. 2 PM - 2 AM)
- ISP controls content routing via BGP MEDs
- Native IPv6 Support
- No user-identifiable information stored locally

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Storage

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Global

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Fill traffic

- On demand filling (NOT caching)
  - Fill traffic only present when catalog changes
- Off-peak fill
  - No impact to the ISP traffic during peak hours
- Real-life volumes
  - Storage: **1.2 Gbit/s** / 12 hours / day
  - Global: **450 Mbit/s** / 12 hours / day
- Peer/tier filling
  - OCAs can fill each other at cluster sites
  - OCAs can fill between clusters
  - More: http://techblog.netflix.com/2016/08/netflix-and-fill.html

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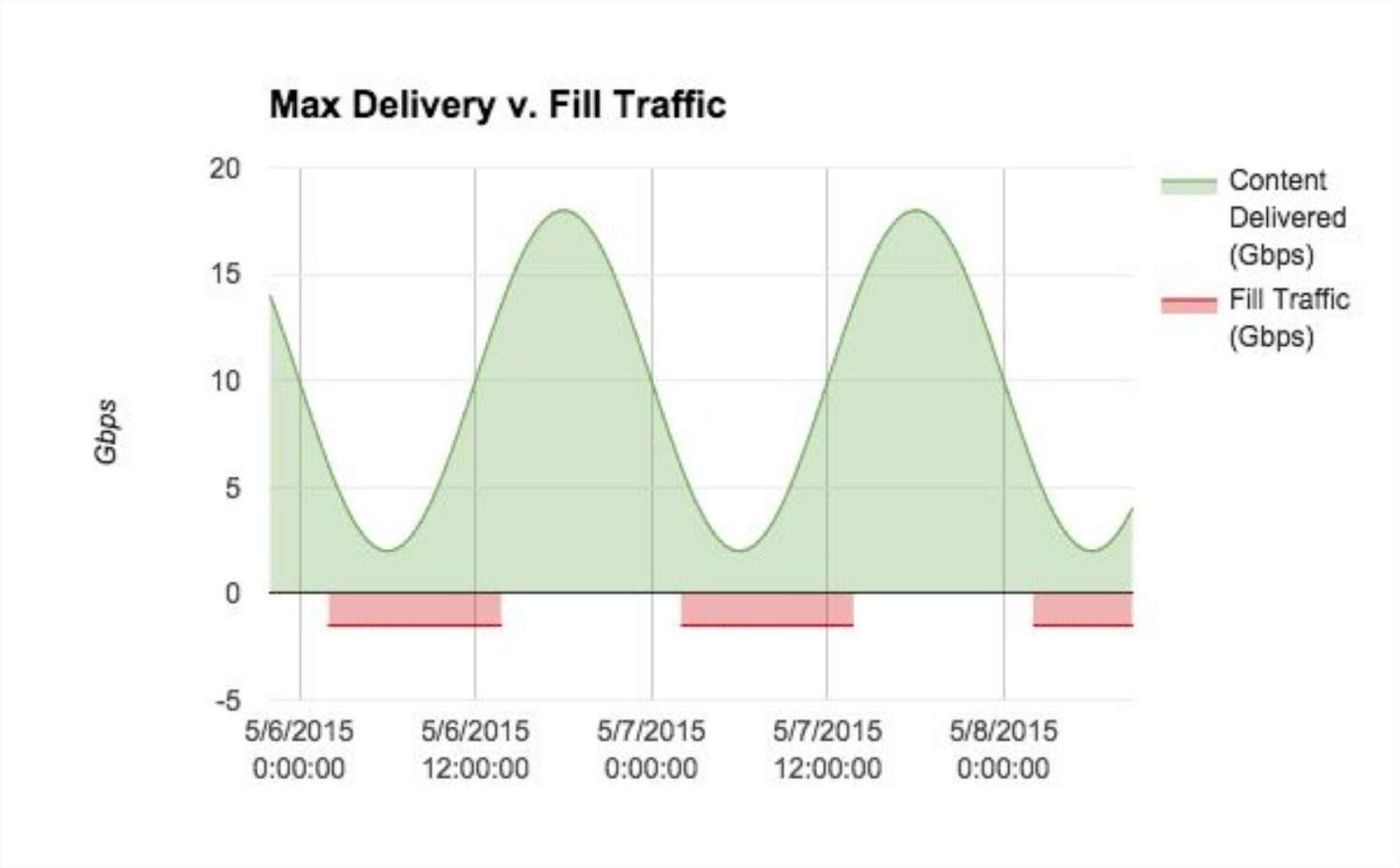
Impact of OCA Fill & Offload



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Open Connect Support

- **Netflix monitors all OCA appliances 24x7x365**
- **Minimal ISP involvement**
  - Power, network cables, and optics included with each OCA for install
  - The only field-serviceable components are optics and power supplies
- **Units replaced in case of defect**
  - Netflix CDN Operations will contact if hardware performance degrades
  - Netflix will ship a replacement OCA and the impacted hardware is returned in the same packing. All costs covered by Netflix.

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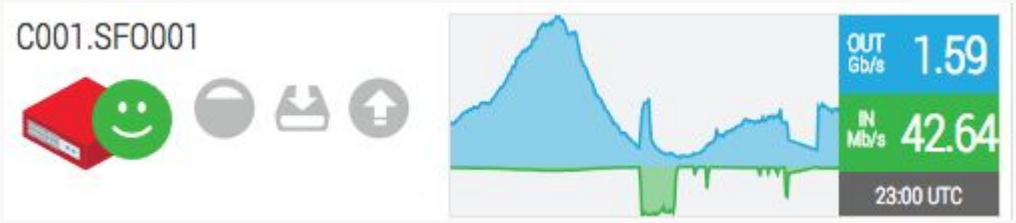
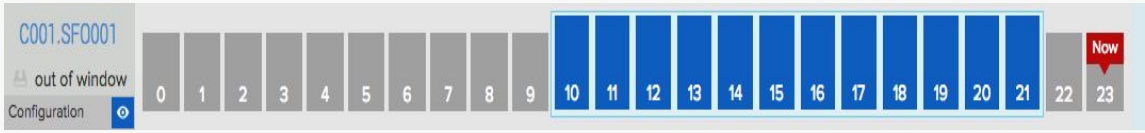
OCA Partner Portal

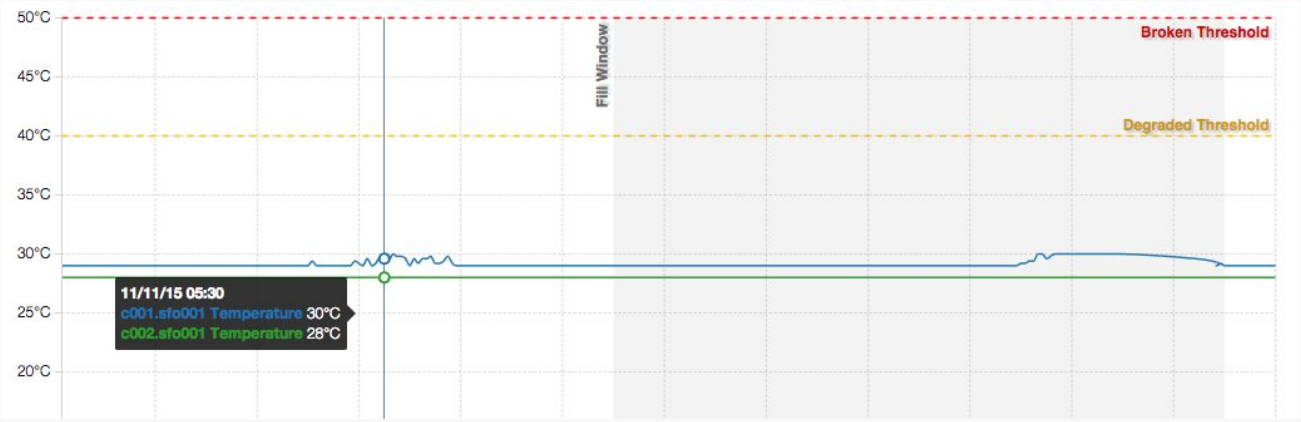
Traffic Statistics



Fill Window View (UTC)



Environmental



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OCA Partner Portal

- BGP self-service tool

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OCA ISP Requirements

- Minimum Peak Traffic Requirements
  - Based on Netflix country catalog sizes
  - > 5G in North America and Western Europe
  - > 1G in rest of world
- Space and Power
  - Minimum 2U of rack space / 550 watts
  - 2U and 1U expansions, deployment architecture dependent
- 2x10G for connectivity (4x10G for flash expansion)
  - Hardware architecture customized for your network
- Process
  - Short Agreement: Software license and Hardware transfer
  - Deployment architecture with Netflix CDN Operations
  - Site survey for each location
  - Additional information - http://openconnect.netflix.com

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Netflix in Italy

- Launched in October 2015
  - First Italian Netflix Original: **Suburra**
  - Original content: **Narcos**, **The Crown**, etc.
- Netflix peering in Italy
  - Public peering: MIX and TOP-IX
  - Private interconnection: Avalon MMR (Infracom)
- Open Connect Appliance
  - Small model (Global) available to ISPs with >1 Gbps
  - Large model (Storage) available to ISPs with >5 Gbps

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Content delivery in Italy

- Interconnection
  - Most of the traffic delivered locally
  - Large peering presence (Milan)
  - Growing embedded presence at ISP premises
  - Only **~1.4%** IPv6 (!!!)
- Strong dependency on Milan
  - **Pros**: the absence of meaningful alternatives drives localization
  - **Cons**: small operators without presence in Milan are penalized
- Working around the Milan dependency
  - Lower the threshold for ISPs to qualify for embedded solutions
  - Evaluate alternatives to Milan over time

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Milan considerations

- The Caldera business campus
  - Oldest and most interconnected place in Italy
  - The number of local datacenters is sufficient to cover most needs
  - In-campus fiber connectivity is accessible (at a price)
- The Avalon MMR
  - Mostly populated MMR
  - In-campus alternatives do exist
  - The de-facto situation is self-sustaining
- The Italian market
  - Traffic growth is forcing large operators to localize
  - Long term benefit potential for small operators

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Questions?

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