

# NETFLIX OpenConnect Appliance deployment guide

v3.7 (APR'15)

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# OVERVIEW

Netflix delivers Streaming Video On Demand via the Internet to its subscribers. That streaming traffic may be a significant amount of overall traffic on Internet Service Provider (ISP) networks. The Netflix OpenConnect program is designed to offload backhaul traffic for ISP's and provide the best user experience to subscribers.

OpenConnect is made up of two components:

- Partnering with ISP's to embed OpenConnect Appliances (OCA's) directly in their network.
- OpenConnect peering points at major Internet Exchanges (IX's)

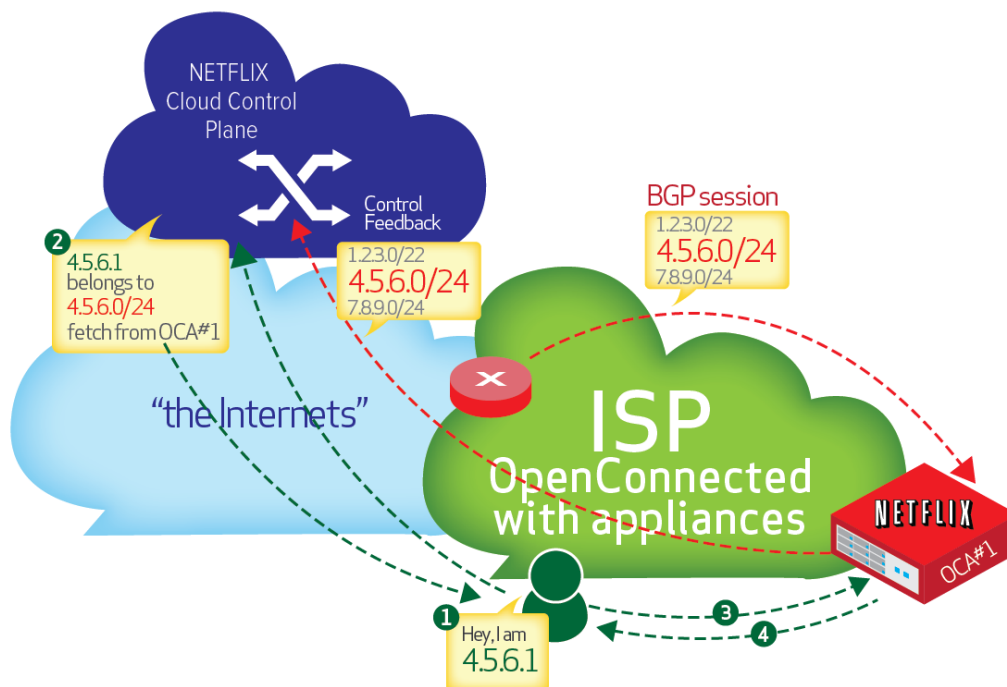
## HOW THE OPENCONNECT APPLIANCE WORKS

It is a **directed cache appliance** in that the manner in which traffic is directed to the appliance is determined by the ISP and by Netflix, not by the appliance itself:

- ISP's control (by BGP advertisement) the mapping of their customers' IP netblocks to particular appliances.
- ISP's may add or remove routes at will. These changes are synchronized with the Netflix Content Delivery System every few minutes.
- Netflix Content Delivery System directs content requests from Netflix client devices within the advertised netblocks to the appliance when:
  - o The requested content is available on the appliance.
  - o The health/load of the appliance is sufficient to satisfactorily handle the request.

*In this way, ISP's can control the sources from which Netflix traffic flows across their network, including planning for capacity and availability, but are relieved from all other aspects of appliance management, including maintenance, repair, and replacement.*

The diagram that follows details how OpenConnected ISPs control traffic on their appliances via BGP advertisements of their subscriber prefixes.



Unlike a transparent proxy, or a demand-driven caching appliance (also referred to as Reverse-Proxy Cache), it is not an active network device and does not attempt to inspect or intercept traffic flowing across the network; rather it only handles the traffic which is purposely directed it.

- Netflix places only Netflix audio and video files in the OCA.
- The operation and performance of the OCA affects only the set of ISP subscribers who also subscribe to Netflix.
- The OCA will only serve clients on IP addresses advertised to the OCA via a BGP session
- The appliance does not retrieve content at the time the client request is received, it will only receive requests for content it already has on disk. OCAs catalogs are populated nightly based on Netflix's popularity algorithms. In other words, Cache-miss behaviors do not exist with OpenConnect appliances.

## HOW PEERING WITH OPENCONNECT WORKS

ISP's may establish peering sessions with Netflix OpenConnect at IX's where both the ISP and Netflix have presence. ISP's advertise the prefixes they would like served over the peering session via BGP. There is no minimum bandwidth requirement on public peering, however once the bandwidth exceeds several gigabits, a private network interconnection (PNI) should be setup. Additional peering information and a list of locations can be found on Netflix's public [PeeringDB record](#).

OCA's are typically deployed in conjunction with Netflix OpenConnect peering.

Ideally, peering acts as a complement by providing redundancy in the case of appliance failure. Long-tail content and cache updates will also be delivered from peering.

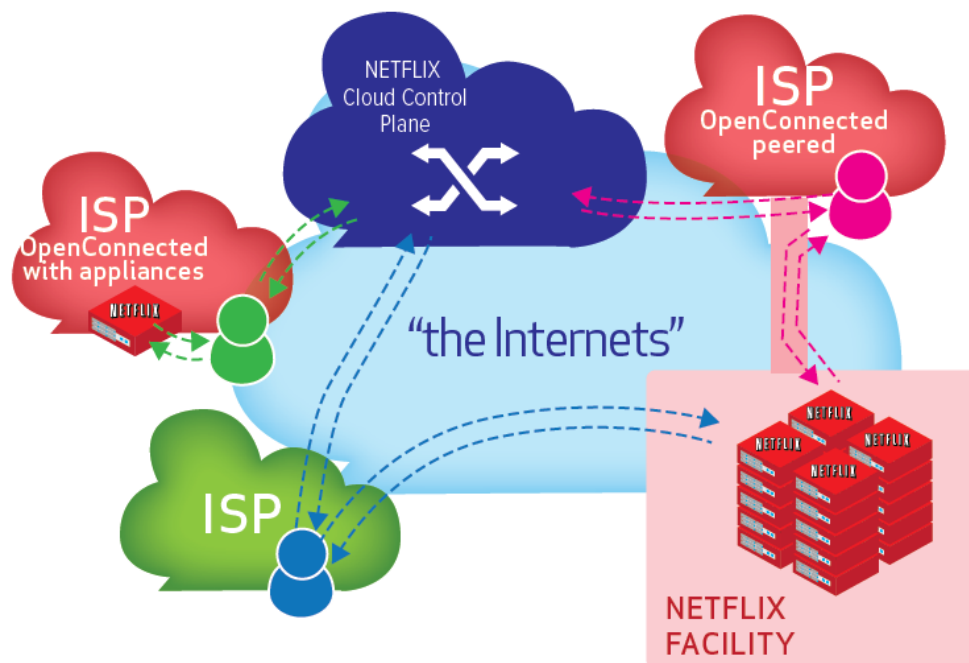
The percentage of traffic served via peering will vary substantially depending on

- the number of appliances deployed
- how they are clustered.

For certain sites where ISP's deliver traffic directly from the IX, peering alone is sufficient.

For ISPs who do not choose to peer with Netflix, content will be filled from transit networks, and Netflix will not be responsible for any costs associated with appliance fill traffic. That being said, OpenConnect appliances can be configured in a way that allows them to fit the trough of your network traffic, therefore allowing the fill process to have reduced if not null impact on your upstream transit costs.

*The diagram below displays cases of ISPs with OpenConnect Peering, OpenConnect Appliances and how their subscribers are routed accordingly towards Netflix content.*



## OPENCONNECT APPLIANCE HARDWARE

Three models of OpenConnect appliance are available, Rev. A and Rev. C and Rev. D. Revisions A and C are 4 Rack Unit devices, which run the Netflix content delivery software and come pre-loaded with content.

The Rev. D is a specific purpose appliance that is used as a local, SSD based 1 rack unit front tier that feeds on Rev. Cs and doesn't come pre-loaded with content (it only takes a few days for a D to fill off of a C).

During the [planning phase](#) Netflix will determine whether a Rev. A or Rev. C (and sometimes Rev D.) appliance is suitable. The appliance you receive is the same field-proven appliance Netflix uses in its own data centers and peering locations.

- Netflix is able to monitor the health and performance of each appliance, as soon as it gets connectivity. As soon as enabled, appliances start reporting these health values and get their configuration from our Cloud Control Plane.
- Health and system load information feedback is automatically incorporated into Netflix content routing decisions
- Appliances are designed for high availability.
- Appliances include redundant system drives, power supplies, and network interface ports.
- There are no user replaceable parts, with the exception of the power supplies and SFP+ optics. Netflix will ship replacement Power Supplies in case of failure.
- If a hard drive fails, it is disabled and the system will continue to function normally. Once a number of hard drives have failed, Netflix will replace the appliance by shipping a new one.
- ISP partners must specify the power supply type (AC or DC) and 10G optics (SR or LR) type.

## OPENCONNECT APPLIANCE SOFTWARE

The OpenConnect appliance is a high-performance web server integrated with the Netflix Content Delivery System, utilizing both Open Source and custom modules.

- Operating System: [FreeBSD](#)
- Web Server: [NGINX](#)
- BGP daemon: [BIRD](#)
- The remaining software on the system manages content and communicates system health and other statistics to the Netflix OpenConnect Cloud Control Plane.
- IPv4 and IPv6 are fully supported

The appliance runs an internal firewall designed to be connected directly to the public Internet, however if you desire to limit the ports, which are accessible, please follow these guidelines:

- Outbound: allow all destination addresses and ports
- Inbound: allow TCP 22, 80, 179, and ICMP types 0, 3, 8, 11 from any public IP/port, as well as return traffic from any appliance initiated connection.

Netflix usually advises to not implement ACLs on the ports facing the appliances as security mechanisms in place usually provide for the necessary security.

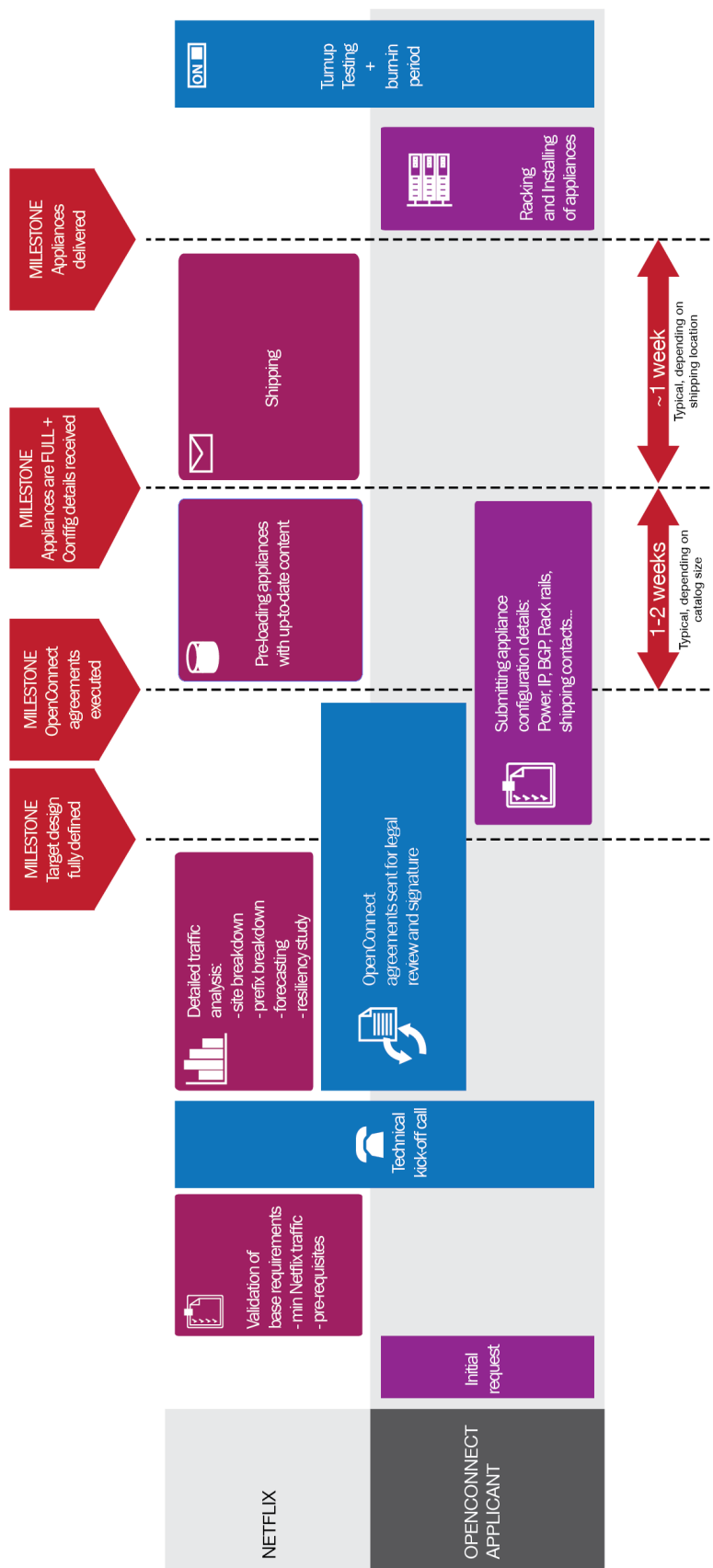
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Additional hardware and software information can be found on the OpenConnect [website](#).

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# PLANNING

The usual process for an OpenConnect applicant ISP is as follows:





This process starts upon submission of an [online](#) OpenConnect request (or from the business development channel, as preferred) and completes once the appliances are set live after a two days burn-in time during which our Operations Engineers keep a close eye on their status.

The Netflix OpenConnect Partner Engagement and Operations team will work directly with your network planning and engineering teams to analyze traffic patterns within the various regions of your network, and determine the appropriate number of appliances for each location, as well as the best resiliency options. There are three models of OCA's, all of which are best suited for sites delivering 5+Gbps of Netflix at peak hour.

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*The appliances are provided free of charge to qualifying partners, and are not for sale to other parties.*

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## TRAFFIC ANALYSIS AND SIZING

The number of appliances deployed is determined by three factors: the availability required at a given location, the amount of Netflix traffic (bandwidth) delivered from that site, and the percentage of that traffic you wish to originate from that location.

Upon reception of your request to join OpenConnect and obtain OCAs, Netflix OpenConnect Partner Engagement Managers will run a traffic analysis on the AS Number you provided to determine if your levels of Netflix Traffic are currently or in a mid-term future above the 5Gbps mark. The next step is for them to map current traffic volumes to our internal region forecasts and try and come up with an OpenConnect OCA setup that will sustain your future peak of traffic for the year to come.

During this stage of the design, the Partner Engagement Managers can/will also run traffic reports on specific prefix groups, so that they can determine the current and future capacity requirements for each of the locations you would want to serve traffic from. The underlying idea being of course to try and achieve a design where the maximum resilience factor is reached, and Netflix content is served as close as possible to your end users.

- An individual appliance can offload approximately 60%-80% of content requests, depending on country catalog size.
- An individual Rev. A appliance can deliver 7Gbps+ of sustained network throughput and a single Rev. C appliance can deliver either 9 or 12-15Gbps depending on whether it is connected in LAG configuration.
- Deploying additional appliances to serve the same client traffic can increase the total throughput as well as the percentage of content requests served.
- Appliances are typically deployed in an N+1 configuration for availability
- Multiple tiers of appliances can be deployed within an ISP network, depending on density of traffic in individual locations, as well as connectivity between metro regions (see Appendix 2: Traffic Management for more detail on how tiers are configured).



## FILL / UPDATE OPTIONS

By design, OpenConnect appliances follow a “Proactive Caching” methodology – they will fill for daily content updates every day during a configured fill window, which will be defined together with your network planning team, in a way that it matches your traffic profile e.g.:

- During the trough of your traffic
- Without disrupting your inbound traffic peaks
- In a way that your 95%ile upstream doesn’t increase, making sure the fill process doesn’t add to your traffic costs

Each appliance stores a portion of the catalog, which in general is less than the complete content library for a given region. Popularity changes, new titles being added to the service, and re-encoded movies are all part of the up to 7.5TB of nightly updates each cache must download to remain current. We recommend setting up a download window during off-peak hours when there is sufficient free capacity.

- A 10 to 12 hour fill window, typically from 2AM to Noon (local time) at a maximum rate of 1.2Gbps per system, is recommended.
  - o This method allows the system to continue to download, while serving clients without affecting their playback performance.
  - o The system may complete downloading updates before the end of the window, and may start again if new content becomes available within the fill window.
- Additionally, if Rev. Ds are part of your network, they will be configured to fill as much as possible from the Rev. Cs that are on site. Because they are SSD based, they will be configured in a way that their fill window will be 4 Hours, and they will not serve while filling. (this means that during the Rev. D's fill window, all Netflix traffic will be served by the Rev. Cs behind)

### Peer Filling

OCA's that share content (clustered) or that are on the same subnet, will attempt to fill from each other. For example, if appliance#1 downloads a movie, appliance#2 will seek to download the movie from#1 instead of transit or OpenConnect peering. Routes to the OCA's should be advertised over OpenConnect peering to ensure the peering session is utilized for fill traffic.

### Tier Filling

Additionally, appliances that see each other's IP address in their BGP feed will consider filling from them as their second best option (after same subnet or same cluster). What this means is that if two separate clusters are located in two different sites and you want them to feed off of each other, you should make sure that appliances within one cluster hear the subnets from the other cluster via the BGP connection that is established with your router.

## CLUSTERING

Two or more appliances receiving the same route advertisements may be put into a cluster, such that they share content. For example, in a typical two OCA cluster both machines will use approximately 40% of their storage for the same most popular content. This popular content typically represents roughly 60% of the OCA's total offload. The remaining 60% of storage space on each is used to store unique/long-tail content, thereby representing a larger portion of the content library and providing greater offload. Redundancy is generally acceptable in a two-OCA cluster; in the case of a single OCA failure, the healthy appliance will take over ~75% of the traffic which the failed unit was serving.

When the combined storage of the cluster exceeds the entire size of the content library, multiple copies of the same content will be present on the appliance's hard drives. This allows the system to deliver more streams of that particular content.

Appliances do not necessarily need to be in the same facility to be clustered. They may not receive the same MED on the routes which are advertised in order to prefer or de-prefer routes which are local or remote to that site. It is important that the sites are well connected, as some traffic will be delivered between the sites, especially in the case of an OCA failure.

### Note on multi-site clusters:

If OCAs on multiple sites are configured within the same cluster, there is a strong chance that they won't be numbered within the same subnet. Remember that OCAs will try to fill off of each other when any of the below applies:

- OCAs are on the same subnet
- OCAs are in the same cluster

In this case, the "same-cluster" rule applies and OCAs will in priority fill from each other for the common, replicated portion of the content.

*The technical benefits of clustering are illustrated in **Annex: Technical In-Depth**.*

## SHIPPING AND RECEIVING

Once the OpenConnect agreements have been executed, Netflix will pre-configure the OCA, as well as fill it with the latest content. Once the systems are completely full, they will be shipped directly to facility.

Before appliances are shipped, OpenConnect ISP Partners will be directed to an online form to specify the final configuration details of their appliances, such as: Site addresses, Shipment contacts, IP configuration details (IPv4, IPv6, Default GW...), BGP Configuration details (IPv4 and IPv6 if necessary), type of rack rails (2 Posts vs 4 Posts), Power Supply types (AC vs DC), optic types (LR-Mono, SR-Multi).

Your datacenter (or other designated location) must be able to receive the appliance shipment as follows:

- Estimated appliance weight: 100 to 125 pounds (Rev. A to Rev. C)
- Estimated weight of pallet and shipping materials: 63 pounds
- Upon request, Netflix will ensure delivery trucks arrive with a pallet jack and lift gate if a loading dock and jack are not available at the destination.
- Inside delivery may also be request.
- It is recommended to get the appliances online as soon as possible, because pre-loaded content quickly becomes stale.

## REPLACEMENTS APPLIANCES AND RETURNS

Netflix will send an advanced RMA replacement appliance. Within the US, overnight shipping will be used. Outside the US, every effort to expedite the delivery will be made. The defective unit may be picked up for return separately, with Netflix coordinating shipping logistics. The defective unit should be returned using the pallet and container the replacement arrived in.

In the event of a hardware failure, please contact Netflix NOC for assistance.

(See the OpenConnect Operating Level Agreement ([OLA](#)) for details)

# INSTALLING AND RUNNING YOUR OPENCONNECT APPLIANCES

## RACKING AND INSTALLATION

Netflix ships the appliance to the ISP's designated location ready to deploy. ISP's are responsible for racking the appliance as well as providing space, power and a 1 or 2 10Gbps optical network connection (depending on OCA version).

- Appliances are shipped with the latest content set, ready to operate: if you rack them and configure your router end according to the configuration details you provided for us to stage them, they should be ping-able when coming online.
- 2 post or 4 post rail kits are included, depending on your preference (this will be discussed with your Partner Engagement Manager).
- Power supplies should be connected to appropriate sources – again, a choice between AC or DC Power Supply Units is offered, this should be
- Fiber patch cables are provided on request to connect the 10G interface(s) from appliance to router/switch.

Rail kit instructions are shipped with the appliance and can also be found [here for RevC servers](#) and [here for RevD servers](#), both are now 2 and 4 posts friendly.

## CONFIGURATION AND TRAFFIC STEERING

The OpenConnected ISP controls what networks the appliances will serve via BGP advertisements. Typically ISPs will establish a BGP session between the appliance and the router it is connected to. Best practice is to advertise the most specific routes to the appliance. MEDs may be injected and will be respected, but communities will be disregarded. By using MEDs an ISP can de-preference routes between appliances.

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As an implicit requirement, **all** appliances need to have a BGP session setup towards the facing router or they will not know about what prefixes they are allowed to serve.

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Appliances should hear each other's routes for appliance to appliance fill, and if peering is established the routes to the OCAs should be advertised over peering as well so that the peering link is preferred as a filling source.

Advertised routes are synchronized with the Netflix Content Delivery System approximately every five minutes. Thus an ISP may add or remove routes at will to affect the amount of requests the OCA receives.

## ENABLING THE OPENCONNECT APPLIANCE

Once the appliance is initially brought on-line at the ISP's site, please notify your Netflix partner engagement manager or the OpenConnect Operations team. See Appendix 7 for Contact Information.

Best practice is to let the system burn-in for two full days, with downloading of updates enabled. This helps identify whether there are any hardware (i.e. as a result of damage during shipping) or network issues prior to enabling the system to serve client traffic.

A BGP session with the appliance may be established at any time during the burn-in period. The appliance will not start serving client traffic until both the ISP and Netflix have agreed that the system is healthy and

ready to serve. Once ready, Netflix OpenConnect Operations will enable the system to serve and will closely monitor its performance.

## TESTING THE OPENCONNECT APPLIANCE

Netflix extensively tests every revision of the appliance hardware and software with every supported Netflix client (as incorporated into various consumer electronics devices such as digital televisions, Blu-ray players, game consoles, iPads, etc.). There is no need for ISPs to perform client-based testing or analysis, as this is an integral part of the Netflix service offered to our subscribers.

In practice, the best way for ISP's to become familiar with appliance operation is to work with the OpenConnect Operations team to initially enable small amounts of production traffic to the appliance. For example, ISP's may start by advertising over BGP with a small number of short prefixes in order to gain comfort and observe network behavior.

Netflix collects a wealth of performance data for each subscriber interaction, and we are able to share summarized performance data with participating ISPs during turn-up, and in an ongoing fashion once appliances are in full production.

## TAKING AN OPENCONNECT APPLIANCE SETUP TO THE NEXT LEVEL.

The OpenConnect control plane offers a wealth of possibilities through the use of BGP to the appliances. Complex resiliency scenarios can be achieved mixing and matching OpenConnect Peering and Appliances, down to multi-tiered fallback scenarios.

- Make sure to read the *Traffic Management* section of this guide, as it provides for a simple and useful scenario of OpenConnect Traffic Engineering
- Make sure you mention as clearly as possible to your OpenConnect Partner Manager the solution that best fits the internal constraints of your network to obtain the most effective advice and resulting OpenConnect setup.

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*OpenConnect Appliances are designed to respond to most of your technical constraints as an ISP to serve Netflix content. In the event that you would come across missing features/capabilities preventing OpenConnect Appliances to function in the most efficient manner, please do not hesitate to share with your Partner Manager.*

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## MONITORING AND MAINTENANCE

Netflix continuously monitors all aspects of the quality and availability of the Netflix service, including the performance and availability of the appliance. See the [OLA](#) for details including process for performing routine maintenance and an issue escalation procedure.

In order to take an OCA out of service an ISP may remove all routes from the BGP advertisement or shutdown BGP to the appliance completely. After approximately 2 hours, all client connections will have completed and the appliance can be safely taken offline for maintenance. Netflix NOC can also assist with taking an OCA out of service as well.

A Portal where ISP partners can view graphs of performance metrics and other useful statistics is being developed, and will be available in the coming months.



## RECONFIGURING THE IP ADDRESS OF AN OCA

For Rev. A appliances, please contact Netflix OC Operations for the procedure.

For Rev. C appliances, the IPv4 address can be updated via the LCD panel on the front of the chassis.

### **Note:**

Rev. C appliances may also be reconfigured to use two 10G interfaces (running LACP based LAG) or configured to use a single 10G interface via the LCD panel.

Please notify Netflix OC Operations of any IP or LAG changes.

## AUTOMATIC SOFTWARE UPDATES

Netflix manages the appliance software, and will periodically update the appliance software. Any non-emergency updates are performed during the cache fill window with notification to the partner (see the [OLA](#) for notification details). All appliance software, including OS, web server and control code is updated as a single image. In the event a new image fails to properly load, the appliance will automatically fallback to the last previous image.

Partners should expect to see a link and BGP session flap as the appliance reboots to load the new image.

# TRAFFIC MANAGEMENT

The Netflix Content Delivery System is aware of all aspects of each appliance. Including their contents, the networks each appliance is authorized to serve (based on BGP advertisements), and the available serving capacity of each appliance. Load is automatically balanced between appliances receiving the same advertisements

Appliances only receive requests for content which is already present on their hard drives. In addition, appliances will only receive requests when they have available serving capacity.

Assuming the appliance has the requested movie, has available serving capacity, and is authorized to serve the network which the client is coming from, then the following cache selection criteria is considered by the Content Delivery System when providing clients with a list (typically 3 or more) of appliances to stream from:

1. Appliance which hears the route to the client's netblock most specifically.
  - a. IPv4 prefixes between /8 and /31 (inclusive) will be accepted on OpenConnect Appliances (OCAs).  
*IPv4 prefixes between /8 and /25 (inclusive) will be accepted on OpenConnect peering sessions.*
  - b. IPv6 prefixes between /19 and /64 (inclusive) will be accepted on OpenConnect Appliances (OCAs).  
*IPv6 prefixes between /19 to /64 (inclusive) will be accepted on OpenConnect peering sessions.*
2. Appliance which hears the route to the client's netblock with shortest AS path from client.
3. Appliance which hears the route with to the client's netblock lowest metric (MED).
4. Geographically closest appliance. Client IPs are referenced in the Akamai Edgescape database to determine their location, and that is compared to the Lat/Long of nearby appliances to determine the closest available system.

## Tie-breaking, load-balancing:

If there is a tie on a given criteria, then the next criteria is considered. If there is a tie on all criteria, traffic will be balanced between appliances.

## BGP is not used to route traffic outbound of an OCA:

Routes received by the appliance are *not* used to determine routing for traffic outbound from the appliance; rather the appliance uses a single default route pointed at the gateway of the ISP networks' choosing. Each appliance in the ISP network is required to maintain a BGP session with a router from which it receives routing information.

## OpenConnect peering sessions / Netflix owned OCAs

Netflix uses the same appliances in its data-centers where peering sessions are setup, Netflix owned OCAs connected to their peering router receive the OpenConnect peered routes which supersede transit routes learnt from the same router according to the usual BGP decision mechanism - *in this case, the same prefix received both from Transit and OpenConnect peering will be preferred over peering by a Netflix OCA because of a shorter AS\_Path.*

## BGP SESSION DETAILS

Three elements are required in order to bring up a BGP session with an appliance:

- Globally routable Autonomous System (AS) number
- IP address of router to establish BGP session with (multi-hop is permitted).

## SETTING CLIENT TO CACHE PREFERENCES USING BGP MEDS

ISPs may tag their routes with MEDs. There is no cap on max MED value.

- A missing MED is treated the same as a MED of 0, and indicates that the appliance should receive all servable traffic for the associated prefixes (if multiple appliances receive the same prefix with the same metric traffic will be load-balanced across those appliances) – (also often referred to MED-missing-as-best)
- MEDs greater than zero should be considered “tiers”, and we will select tiers in a weighted manner, e.g.:
  - For prefix **10.10.10.0/24**
    - Appliances 1 & 2 have a weight of 10
    - Appliances 3 & 4 have a weight of 20
    - Appliances 5 & 6 have a weight of 30
  - For prefix **20.20.20.0/24**
    - Appliances 1 & 2 have a weight of 30
    - Appliances 3 & 4 have a weight of 20
    - Appliances 5 & 6 have a weight of 10
  - Traffic for **10.10.10.0/24** will normally flow to Appliances 1 & 2 unless there is a failure or lack of capacity, and then will bleed to Appliances 3 & 4 and potentially 5 & 6
  - Traffic for **20.20.20.0/24** will normally flow to Appliances 5 & 6 unless there is a failure or lack of capacity, and then will bleed to Appliances 3 & 4 and potentially 1 & 2

### Important note: MED Missing As Best

Marking MEDs on already installed and working OpenConnect appliances can be hazardous as it needs to be done on all BGP Sessions of all appliances at the same time. Remember that a missing MED will be equivalent to 0, therefore preferred VS any >0 MED on other appliances.

## AS PATH LENGTH

In the event that a prefix is received from multiple sources, the path with the shortest length will win. Equal length paths will be evaluated by MED and then GEO. If everything is equal then traffic will be load balanced.

### Note on simultaneous Embedded OpenConnect appliances and Peering Sessions:

As stated earlier in the document, the ideal OpenConnect setup is both Peering and Embed of OpenConnect appliances. Netflix uses two separate Autonomous Systems:

- **AS2906** will be used when peering with Netflix’s Routers
- **AS40027** is the AS that contains all OpenConnect appliances

The same prefix announced both to a private or public peering session (using AS2906) and to an OpenConnect Appliance (using **AS40027**) will always be preferred on the appliance over peering, as the OpenConnect control plane will have two BGP entries for that prefix:

- one with an **AS PATH LENGTH** of 1 (**<AS\_NUMBER>**) from the appliance itself
- one with an **AS PATH LENGTH** of 2 (**2906 <AS\_NUMBER>**) from an IX location

In other words, simultaneous use of OpenConnect Appliances and OpenConnect Peering implies that Appliance is nominal and Peering is backup (and long-tail)

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You can take a look at the *Illustrated dual embed and peering, resilient setup* section for a detailed example of how to build a fully resilient scenario across 3 of your PoPs,, achieving an Active/Active load-balanced setup of your appliances.

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## REGIONAL ROUTING

ISPs should also take care to only send routes to appliances for regions that they wish to serve and fill with that specific appliance. Netflix will not attempt to geographically map an ISPs network topology. In the event that an ISP desires that an appliance serve as a backup-only node for a set of prefixes (geographic failover), they should tag the failover prefixes with a MED greater than what is advertised to the primary appliance.

## HEALTH CHECKING

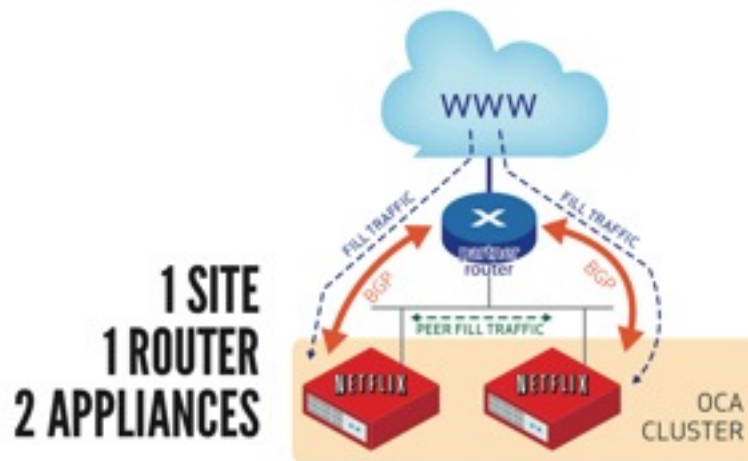
Once the session has been established, Netflix will use the session state as one of their health metrics to ensure that the appliance is still active. In the event that a session is terminated, the Netflix Content Delivery System will no longer direct new sessions to the appliance and the Netflix and customer Network Operations Centers will be notified. Existing sessions will remain with the appliance until they complete unless the appliance software or hardware is shut down.

# ANNEX : TECHNICAL IN-DEPTH

## EXAMPLE TOPOLOGIES

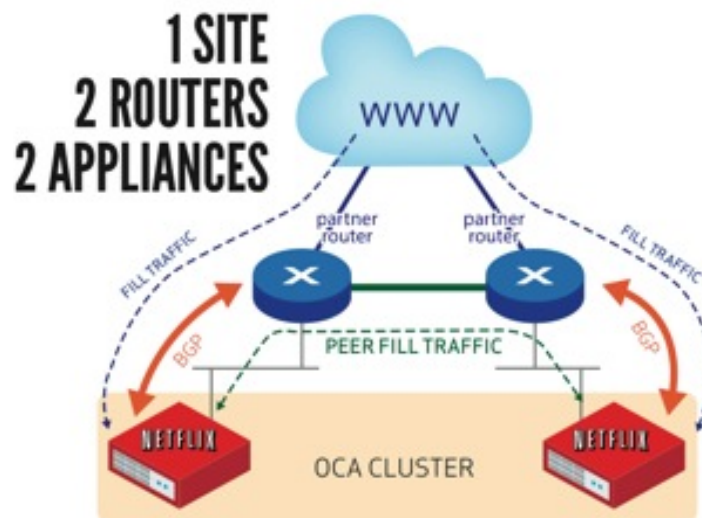
*Single Site with one Router and two Appliances on the same subnet*

Figure 1

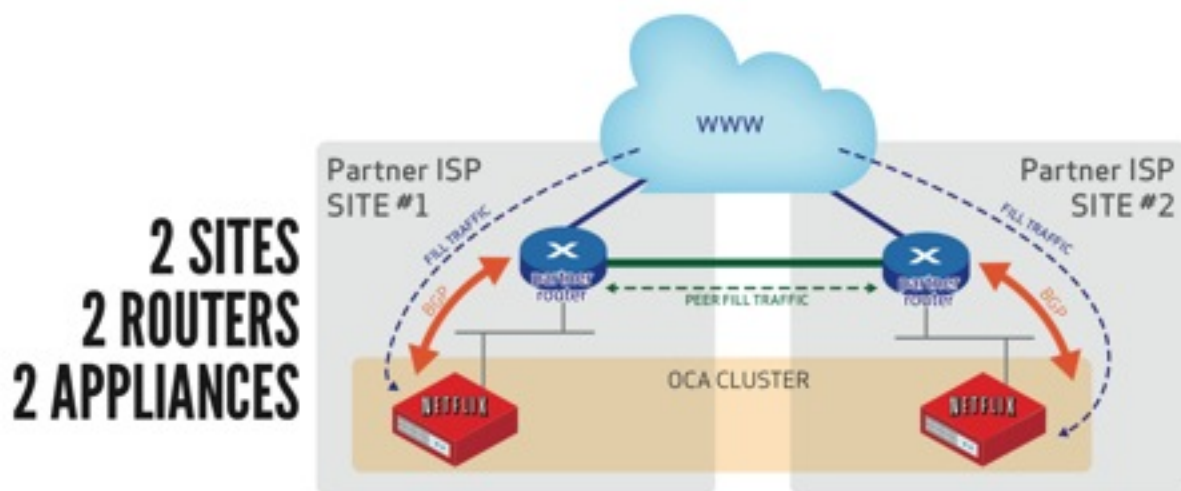


*Single Site with two Routers and two Appliances each on different subnets*

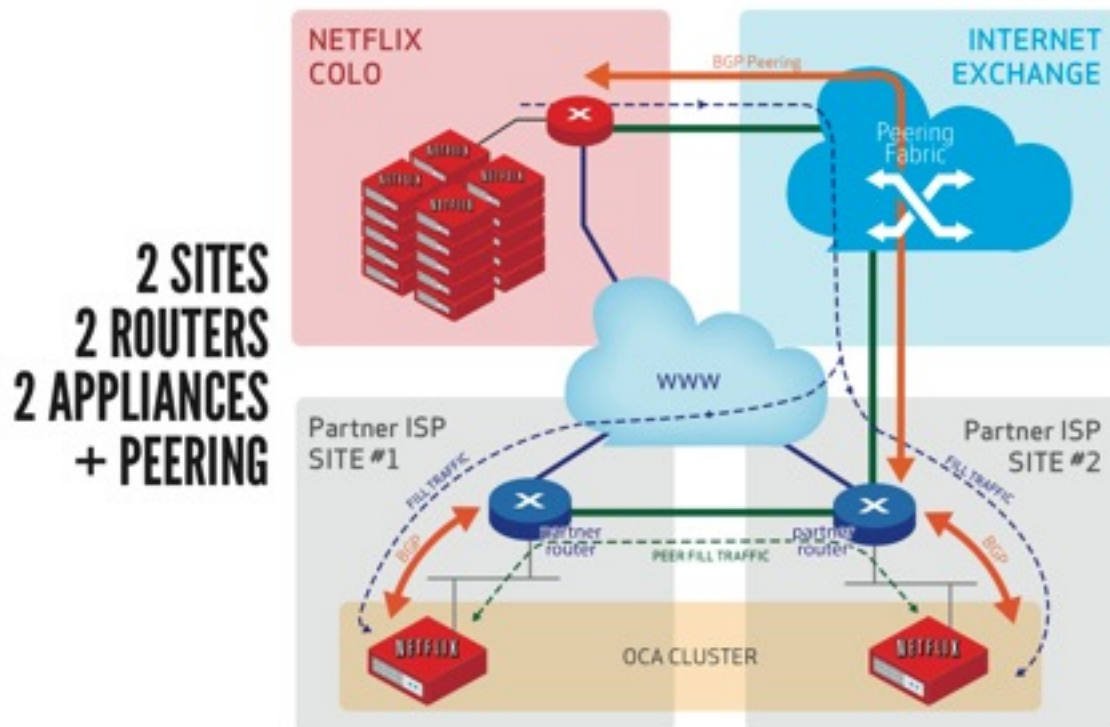
Figure 2



Two Sites, each having an Appliance on its own subnet  
Figure 3

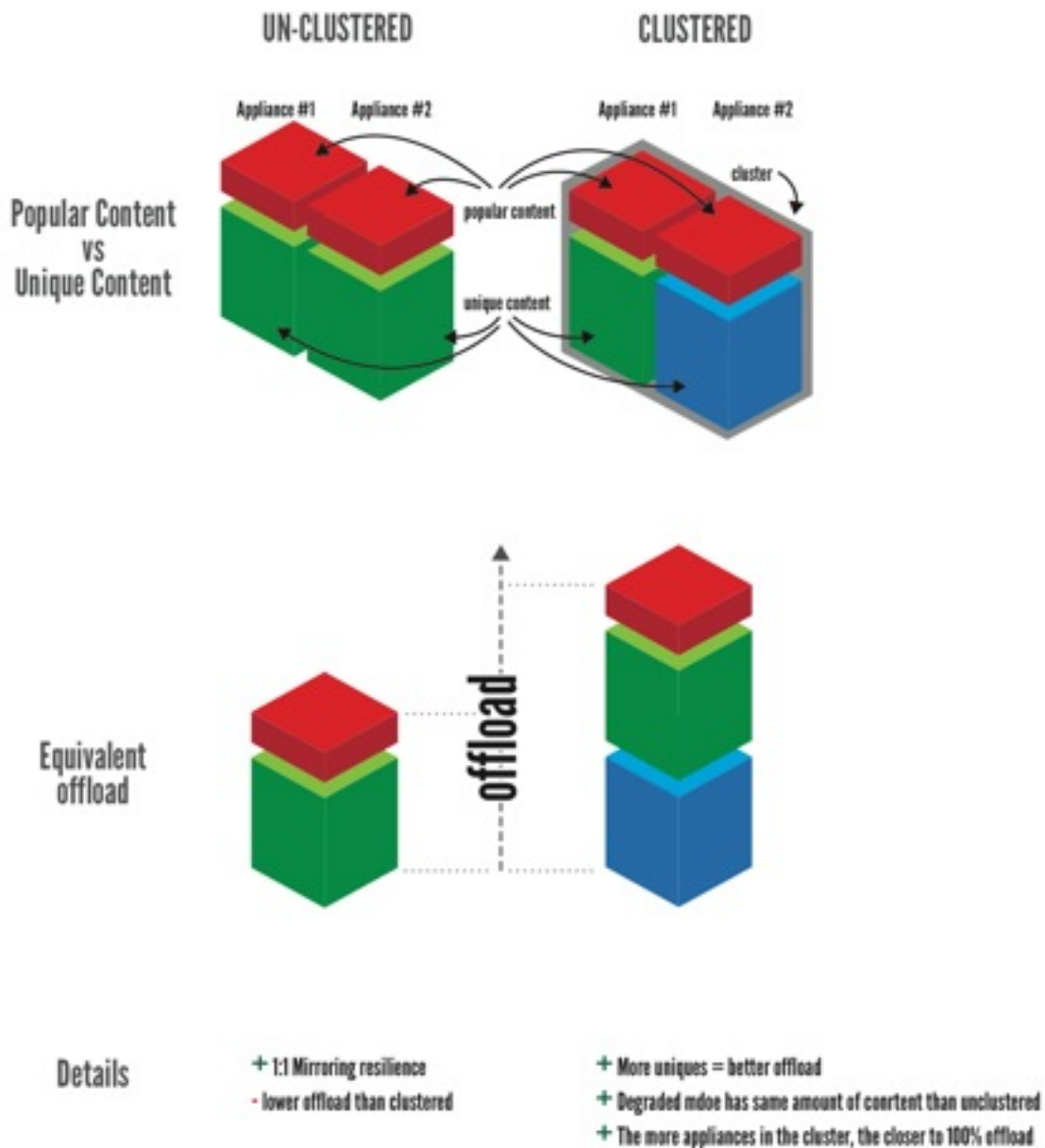


Two Sites, each Appliance on its own subnet and OpenConnect Peering  
Figure 4





# ILLUSTRATION OF THE CLUSTERING CONCEPT

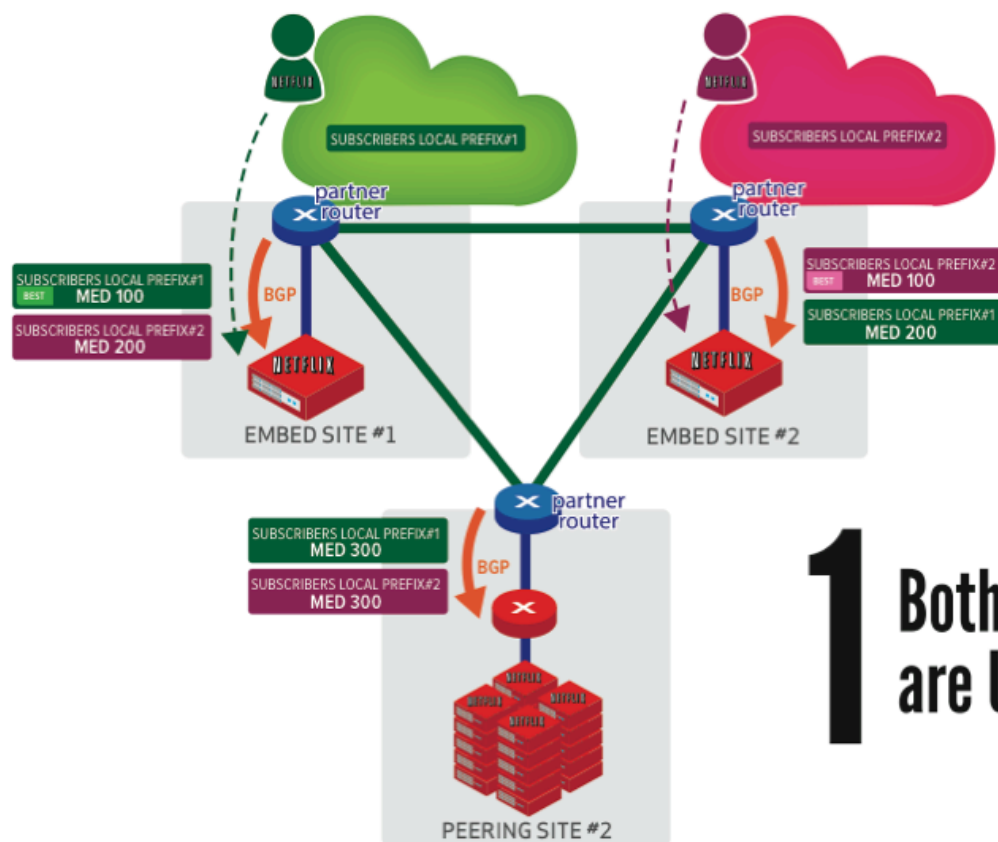


## ILLUSTRATED DUAL EMBED AND PEERING, RESILIENT SETUP

The diagram below displays a wide flavor or setup options combined together into an optimally resilient solution. Amongst others, it displays:

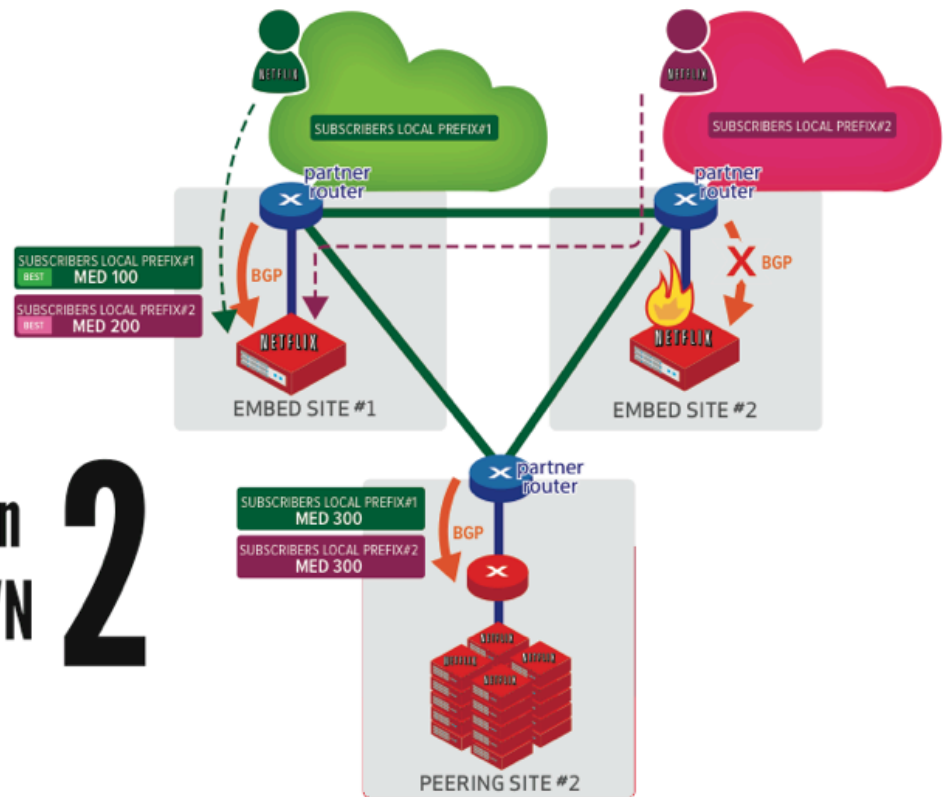
- dual embedded OpenConnect appliances
- OpenConnect peering connectivity in an IX location

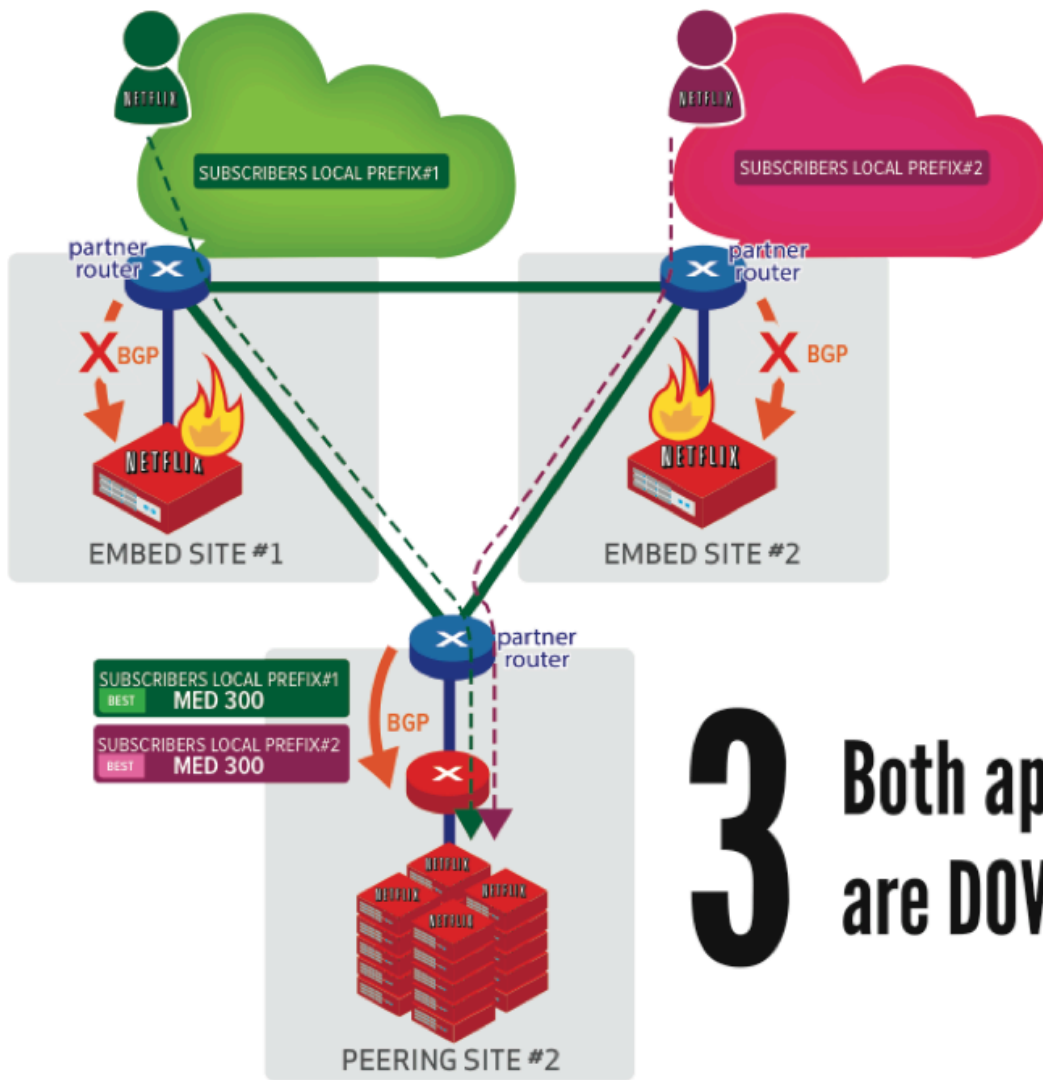
*This set of diagrams displays what happens in a wide array of failover situations: one site goes down, both sites go down...*



**1 Both appliances are UP**

Appliance on  
site#2 is DOWN **2**





**3 Both appliances  
are DOWN**

# FAQ

## How much network offload will the appliance help me achieve?

A single appliance provides significant offload of Netflix traffic. The actual amount varies depending on country catalog size and other factors. Multiple appliances operating together in a cluster can provide even greater levels of traffic offload.

## Can I change the IP address of the appliance after I receive it?

Yes, please contact Netflix OpenConnect Operations for instructions. The updated IP address will only take affect after a reboot, so it is import to ensure there is no traffic on the system.

## Can I change from a single network interface to two?

Yes, however only on Rev. C appliances. Please contact Netflix OpenConnect Operations for instructions. The updated configuration will use LAG with LACP and will only take affect after a reboot, so it is import to ensure there is no traffic on the system.

## What happens in the event of a recoverable hardware fault?

Contact Netflix Network Operations Center (NOC) described in [OLA](#).

## What happens in the event of a non-recoverable hardware fault?

If Netflix cannot recover the appliance, a new one will be shipped to you. Replacement guidelines are described in our [OLA](#).

## How do I determine if an additional appliance will benefit a facility?

Initially, Netflix will work with your network planning group to deploy the appropriate number of appliances to optimize offload for your network. Additionally, Netflix will continually monitor load and recommend additional appliances as needs change.

## How can I change the appliance cache-fill window?

The fill window is initially determined based on your input and an analysis of your network conditions. If you need to change it, contact the OpenConnect Operations team.

## Is any field service required for the appliance?

No. In general, you should not attempt to modify, upgrade, or repair the appliance. Only power supplies and SFP+ optics may be replaced in the field.

## What throughput does the appliance deliver during peak demand?

For planning purposes, we estimate a sustained peak throughput for each Rev. A appliance at 7Gbps and each Rev. C at 9Gbps with a single port or 12Gbps with two ports in a LAG.

## What throughput does the appliance need during fill?

Each OCA requires throughput sufficient to download up to 5TB of new content each night. Lower throughput speed will require a longer fill window and vice-versa.

## What does the appliance cost my organization?

The appliances (and any necessary replacements) are provided to participating ISP's free of charge when used within the terms of the license agreements.

## How can I test the offload performance of the appliance before live deployment?

Netflix can provide estimates to you during planning discussions, however there is very little value to testing in a lab environment. The benefits of the appliance are only realized when they serve video streams to Netflix members. This cannot be replicated in a lab setting.

### **How does the appliance determine what content to cache?**

Netflix uses a popularity-based algorithm to determine what content should be on appliances. A number of factors affect popularity, and the contents of an appliance are expected to change on a daily basis.

### **Is the popularity calculation used to populate the appliance done on a regional basis?**

Testing has shown that a single popularity per country catalog is the most effective model for providing optimal popularity to content change ratios. This analysis continues on a regular basis, and the system allows for continual improvement of popularity algorithms.

### **What size IP address blocks should I assign to the appliance?**

It is acceptable to assign the appliance an address from a larger subnet, i.e a /24, however since only one IPv4 address is required per appliance, a smaller subnet, i.e a /30, may be used.

The appliance supports IPv4 assignments of /31 and larger and IPv6 assignments of /126 and larger.

### **Should appliances in the same site be connected to the same router and / or in the same subnet?**

If there are multiple routers available that can provide redundancy in a site, it is recommended to stagger appliances between routers. Appliances on the same router should be in the same subnet to optimize filling. Appliances on separate routers should be in separate subnets. Appliances are not designed to be connected to 2 separate routers.

### **How do the appliances determine where to receive update / fill content from?**

Appliances follow the same selection criteria that the Netflix client players on devices use. Please see Appendix 2: Traffic Management for more details.

### **How can I tell the difference between Rev. A and Rev. C appliances?**

Rev. C Appliances have LCD panels on the front of the chassis, Rev. A appliances do not.

### **How come there is no Rev. B model of appliance?**

The Rev. B appliance was scrapped during prototyping.

### **Do you allow MD5 digests on BGP sessions?**

No, we feel that it is unnecessary due to other security measures which are implemented.

### **Does Netflix reference BGP communities?**

No, Netflix does not use any BGP community information advertised to OCA's or via OpenConnect peering.

### **Do OCA's support multiple BGP sessions?**

No, not at this time.

### **Do OCA's support Jumbo Frames?**

No, not at this time, please use standard MTU size (1500 bytes).

### **Do OCA's use ICMP rate-shaping?**

Yes, OCAs will drop some packets in the event of a Ping flood test.

### **Do OCA's support VLAN tagging?**

No, VLAN tagging is not supported in OCAs.

### **Are OpenConnect appliances compatible with CGN (Carrier Grade NAT)**

CGN has multiple flavors; some of them are compatible with OpenConnect Appliances, some not. In general, Netflix advises not to use them in a CGN context, should this be mandatory to an ISP, make sure this is mentioned in the early steps of the discussion.

A few "gotchas":



- RFC1918 prefixes announced to OpenConnect Appliances are filtered and cannot therefore be used to deliver traffic to privately addressed end-users.
- Appliances cannot have their IP interface addressed with an RFC1918 IP, even if said IP has a 1-to-1 NAT equivalent from the outside.

### **Can /31 ip addresses be used on the OpenConnect Appliances?**

Yes, OpenConnect Appliance IP addressing is compatible with /31 ranges.

# ROUTER CONFIGURATION SNIPPETS

The snippets below will help you configure the router end of your OpenConnect appliance setup, these have been tested by our Network Engineering team.

## EXAMPLE BGP SESSION CONFIGURATION – CISCO IOS

```
!  
router BGP <ASN>  
neighbor <IP address of Appliance> remote-as 40027  
neighbor <IP address of Appliance> route-map NETFLIX-OUT out  
!  
route-map NETFLIX-OUT permit 10  
match ip address prefix-list NETFLIX-LOCAL  
set metric 0  
!  
route-map NETFLIX-OUT permit 20  
match ip address prefix-list NETFLIX-BACKUP  
set metric 100  
!  
route-map NETFLIX-OUT deny 30  
!
```

## EXAMPLE BGP SESSION CONFIGURATION - CISCO IOS XR

```
router bgp <ASN>  
neighbor <IP address of Appliance>  
remote-as 40027  
address-family ipv4 unicast  
route-policy NETFLIX-OUT out  
  
route-policy NETFLIX-OUT  
if destination in NETFLIX-LOCAL then  
set med 0  
elseif destination in NETFLIX-BACKUP then  
set med 100  
else  
drop  
endif  
end-policy
```

## EXAMPLE LACP CONFIGURATION – CISCO ISO-XR

```
!  
interface Bundle-Ether1  
  bundle minimum-active bandwidth 1  
  ipv4 address <address/mask>  
  ipv6 address <really-long-address/mask>  
!  
interface TenGigE0/0/2/0  
  bundle id 1 mode active  
  lacp period short  
!  
interface TenGigE0/0/2/2  
  bundle id 1 mode active  
  lacp period short  
!
```

## EXAMPLE LACP CONFIGURATION – CISCO IOS

```
!  
interface Port-channel1  
  ip address <address> <mask>  
!  
interface GigabitEthernet1/1  
  channel-group 1 mode active  
  channel-protocol lacp  
!  
interface GigabitEthernet1/2  
  channel-group 1 mode active  
  channel-protocol lacp  
!
```

## EXAMPLE BGP SESSION CONFIGURATION - JUNIPER

```
neighbor <IP address of Appliance> {  
    export NETFLIX-EXPORT;  
    peer-as 40027;  
}  
  
policy-statement NETFLIX-EXPORT {  
    term NETFLIX-LOCAL {  
        from {  
            prefix-list NETFLIX-LOCAL;  
        }  
        then {  
            metric 0;  
            accept;  
        }  
    }  
    term NETFLIX-BACKUP {  
        from {  
            prefix-list NETFLIX-BACKUP;  
        }  
        then {  
            metric 100;  
            accept;  
        }  
    }  
    then reject;  
}
```

## EXAMPLE LACP CONFIGURATION – JUNIPER

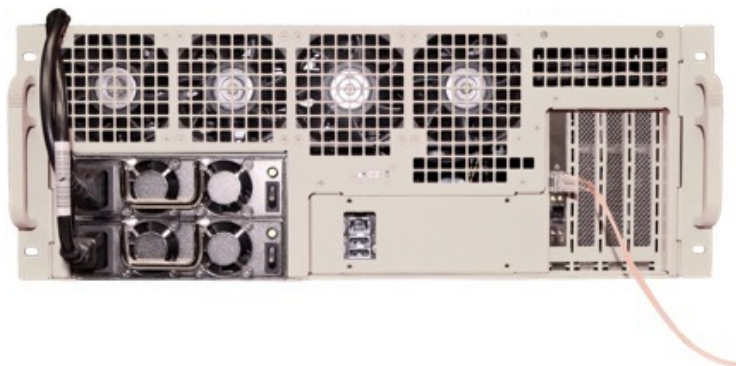
```
ae1 {
  description NETFLIX-OCA;
  aggregated-ether-options {
    lacp {
      active;
      periodic fastslow;
    }
  }
  unit 0 {
    family inet {
      address <address/mask>;
    }
    family inet6 {
      address <really-long-address/mask>;
    }
  }
}
xe-0/0/0 {
  description NETFLIX-OCA-cxgbe0;
  ether-options {
    802.3ad ae1;
  }
}
xe-0/0/1 {
  description NETFLIX-OCA-cxgbe1;
  ether-options {
    802.3ad ae1;
  }
}
```

# APPLIANCES TECH SPECS

## REV. A SPECIFICATIONS

Physical Specifications	
Appliance Weight	100lbs (45.4 Kg)
Shipping Weight	163lbs (74 Kg)
Dimensions	7" x 17" x 23" (17.8cm x 43.18cm x 58.42cm)
Power Draw (peak)	560 Watts
Operational Throughput	7Gbps sustained throughput
Storage Capacity	100TB
Rack space	4 Rack units (4U)

*OpenConnect appliance with AC power supplies:*



*Rev. A OpenConnect appliance with DC power supplies:*





Options	
Rack Size	2 or 4 post rack rails (19" wide)
<p>AC or DC Power Supply (Peak power draw: 560 watts)</p> <p><b>Note:</b> Power Supplies are not hot swappable.</p>	<p><b>AC:</b></p> <ul style="list-style-type: none"> <li>• C14 connector</li> <li>• Voltage: 90 ~ 264 VAC Full Range</li> <li>• 5 amp per feed recommended at 120 VAC</li> <li>• Frequency: 47 ~ 63Hz</li> </ul> <p><b>Note:</b> 2x C13 to C14 and 2x C13 to NEMA 5-15 are provided.</p> <p><b>DC:</b></p> <ul style="list-style-type: none"> <li>• PLB06M connector <ul style="list-style-type: none"> <li>◦ Yellow Negative, Black Positive</li> </ul> </li> <li>• Voltage: -36 ~ -72 V DC</li> <li>• Input current: 16A at -48V DC <ul style="list-style-type: none"> <li>◦ 30 amp fuse per PSU recommended</li> </ul> </li> </ul> <p><b>Note:</b> For configurations requiring DC power supplies, 20' power cables with PLB06M connectors are provided.</p>
Network	<p>LR or SR SFP+ 10GE, LC connector</p> <p><b>Note:</b> Fiber patch cables are provided on request, i.e. 7m SM LC to SC fiber patch.</p>

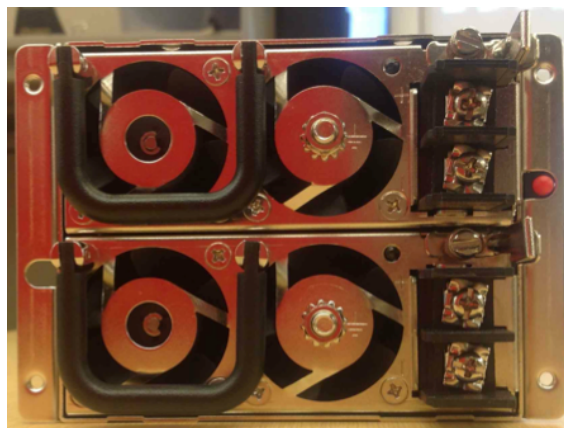
## REV. C SPECIFICATIONS

A few factors result in multiple ‘flavors’ of RevC chassis – which overall follow the same specs:

- Following Moore’s law, available Spinning Disk capacities increase, changing the amount of useable storage on appliances, initial 4TBs built appliances are being progressively replaced with 6TBs appliances
- Netflix has been using two manufacturers for now (and reserves the right to change in the future), although both builds mostly follow the same specs, one will require 670W Peak power (Equus build), whereas the other will be 555 Watts (SanMina build).

Physical Specifications	
Appliance Weight	118lbs (53.5 Kg)
Shipping Weight	181lbs (82 Kg)
Dimensions	7” x 17” x 22.5” (17.8cm x 43.18cm x 57.15cm)
Power Draw (peak)	555 Watts (SanMina build) 670 Watts (Equus build)
Operational Throughput	9Gbps sustained throughput (one port) 12Gbps sustained throughput (two port LAG)
Storage Capacity	120TB if it is a 4TB variant of RevC 160TB if it is a 6TB variant of RevC
Rack space	4 Rack units (4U)





Options	
Rack Size	2 or 4 post rack rails (19" wide)
AC or DC Power Supply (Peak power draw: 560 watts)  <b>Note:</b> Power Supplies are not hot swappable.	<p>AC:</p> <ul style="list-style-type: none"><li>• C14 connector</li><li>• Voltage: 90 ~ 264 VAC Full Range</li><li>• 5 amp per feed recommended at 120 VAC</li><li>• Frequency: 47 ~ 63Hz</li></ul> <p><b>Note:</b> 2x C13 to C14 and 2x C13 to NEMA 5-15 are provided.</p> <p>DC:</p> <ul style="list-style-type: none"><li>• LUG connector</li><li>• Voltage: -36 ~ -72 V DC</li><li>• Input current: 16A at -48V DC</li><li>• 30A fuse per PSU recommended</li></ul>
Network	<p>LR or SR SFP+ 10GE, LC connector</p> <p><b>Note:</b> Fiber patch cables are provided on request, i.e. 7m SM LC to SC fiber patch.</p>

## REV. D SPECIFICATIONS

### Foreword:

Rev. D servers are used exceptionally, mostly in large ISP deployments to provide a local tiered setup where Rev. D are used to feed on Rev. Cs. Your Partner Engagement Manager will define whether these should be used in your setup.

Physical Specifications	
Appliance Weight	31lbs (14Kg)
Shipping Weight	Appliance: 31lbs (14Kg) Rails: 3lbs (1.4Kg) Packaging: 8lbs (3.6Kg) Total: 42lbs (19Kg)
Dimensions	1.7"x19"x23.5" (4.32cm x 48.26cm x 59.7cm)
Power Draw (peak)	165W
Operational Throughput	Quad-port 10GBE NIC 13-17Gb/s using 2 10GBE ports in LACP bundle
Storage Capacity	14TB MLC SSD
Rack space	1 Rack unit (1U)

*Rev. D OpenConnect Appliance back view*





Options	
Rack Size	2 Post rack rails (aka Telco cabinet - regular 19" wide) OR 4 Post rack rails (aka Server cabinet - regular 19" wide)
AC or DC Power Supply (Peak power draw: 560 watts)  <b>Note:</b> Power Supplies are not hot swappable.	<b>AC Power supplies (2N redundant):</b> <ul style="list-style-type: none"> <li>• C14 connector</li> <li>• Voltage: 180 - 240V</li> <li>• Input current 5-3.8A</li> <li>• Frequency: 60-50Hz</li> <li>• Included in package: 2x C13 to C14 and 2x C13 to NEMA 5-15</li> </ul> OR <b>DC Power supplies (2N redundant)</b> 10A fuse per power supply recommended.
Network	SFP+ 10GE, LC Connector <ul style="list-style-type: none"> <li>• 10GBASE-SR Multimode LC Connector</li> </ul> OR <ul style="list-style-type: none"> <li>• 10GBASE-LR Monomode LC Connector</li> </ul> <b>Included in package:</b> Fiber patch cables (upon request), provide length and connector type on the router side

## SUPPORT CONTACTS

Netflix NOC (Repair, Support, Escalation)	Netflix OpenConnect Operations (All other questions)
Role: <b>Netflix NOC</b>	Role: <b>Netflix OC Operations / PEM</b>
Phone: (408) 724-9100 E-mail: <a href="mailto:cdn-noc@netflix.com">cdn-noc@netflix.com</a> Availability: 7x24x365	Phone: (408) 724-9102 E-mail: <a href="mailto:cdn-ops@netflix.com">cdn-ops@netflix.com</a> Availability: M-F 9AM – 5PM PT

## OPENCONNECT PARTNER PORTAL

OpenConnect appliances come with an account to our <https://my.oc.netflix.com> partner portal.

If your Partner Engagement Manager hasn't already provided you with an activation invite, please let him know.

Support for Partner Portal is available via email at: [my.oc@netflix.com](mailto:my.oc@netflix.com)

The getting-started guide for Partner Portal is available [HERE](#)