

How Netflix Works?

ThaiNOG
8th May 2019

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NETFLIX CONFIDENTIAL
NOT FOR DISTRIBUTION

NETFLIX

> 148 million members

> 190 countries

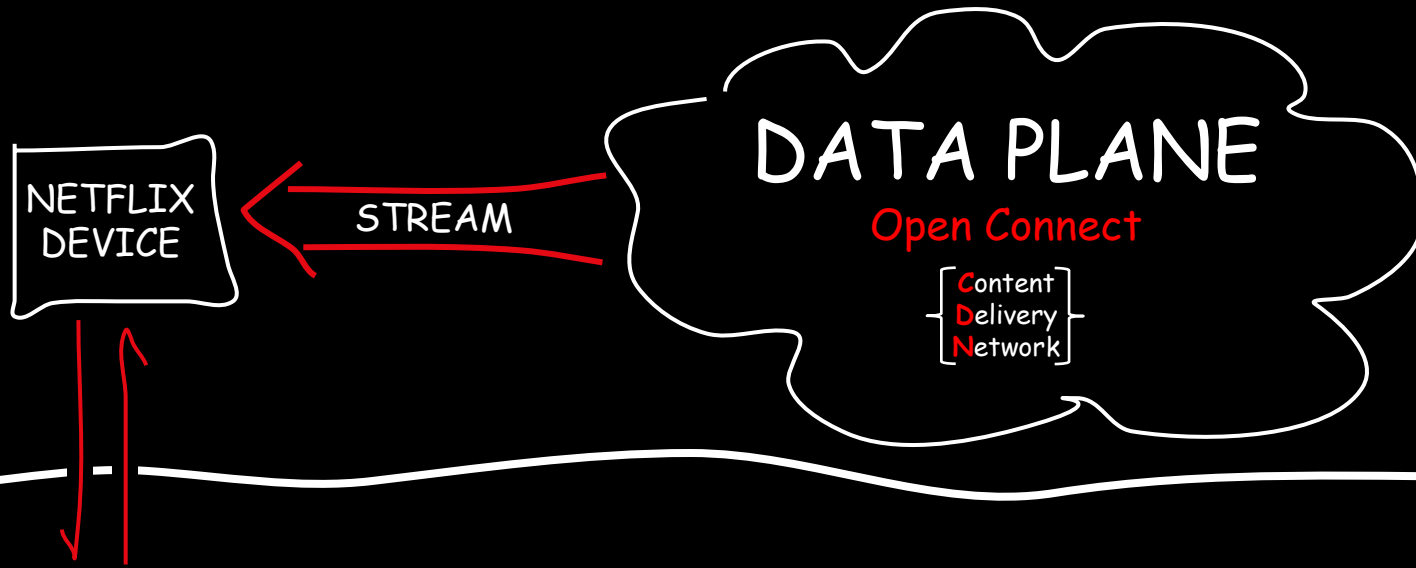
A young man with brown hair, wearing a green jacket over a striped shirt, is looking upwards with a surprised expression. He is standing in a room decorated with numerous strings of colorful Christmas lights (red, green, blue, yellow, and white) that are strung across the ceiling and walls. The room appears to be a living area with a window in the background and a bookshelf or storage unit on the right. The overall atmosphere is warm and festive.

How **NETFLIX** Works

Inventing Internet TV:

- The architecture of internet streaming
- Quality of Experience
- Cost





CONTROL PLANE



NETFLIX ORIGINAL STRANGER THINGS

★★★★★ 2016 TV-14 1 Season

Next Up

S1:E4 "Chapter Four: The Body"

Refusing to believe Will is dead, Joyce tries to connect with her son. The boys give Eleven a makeover. Nancy and Jonathan form an unlikely alliance.



MY LIST



OVERVIEW

EPISODES

TRAILERS & MORE

MORE LIKE THIS

DETAILS

before streaming starts = control plane =



NETFLIX ORIGINAL

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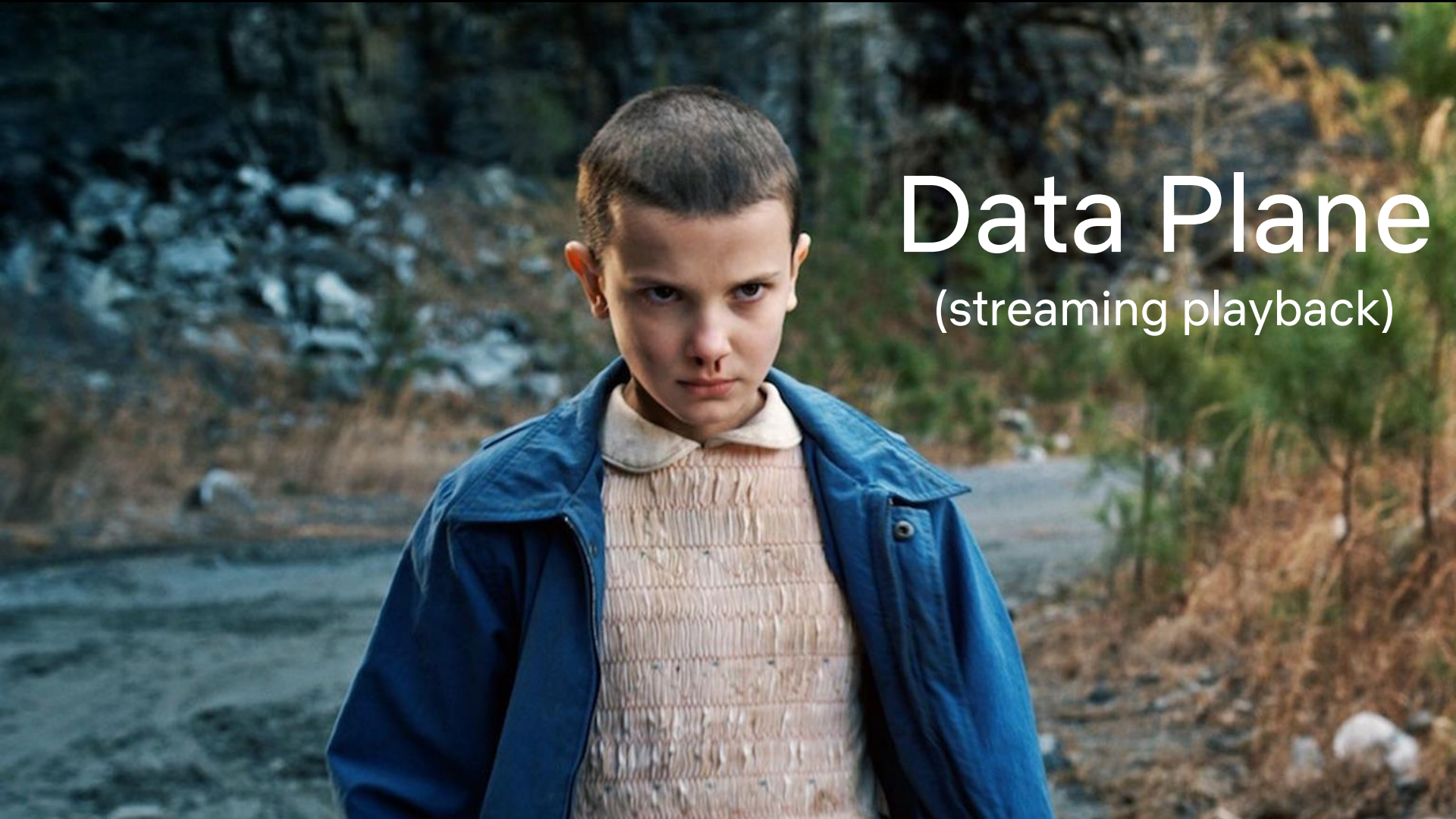
EPISODES

TRAILERS & MORE

MORE LIKE THIS

DETAILS

streaming = data plane = Open Connect



Data Plane

(streaming playback)



The poster features a central collage of characters. At the top center is a large, close-up face of a young boy with a serious expression. To his left is a woman with brown hair looking concerned. Below her are three children: a girl with a fur collar, a boy with a camera, and a girl with a red headband. To the right of the central boy is a man in a fedora holding a walkie-talkie. Below him are three boys riding bicycles with their headlights on. In the background, there is a small wooden shed and a fenced-in area with a sign that reads 'RESTRICTED AREA' and 'NO TRESPASSING U.S. GOVERNMENT PROPERTY'. A glowing green figure is visible behind the fence. The background is a dark night sky with stars and a full moon.

Open Connect

A NETFLIX ORIGINAL

Q: What is a Content Delivery Network?

A: Geographically distributed content servers attached to networks
+
a way of routing requests to the closest (and/or best performing)
server / network path

History

Streaming
Launched
("EHub")
2007

Open Connect
2011

Third Party CDN
2009



Hardware

Open

Connect

Appliances

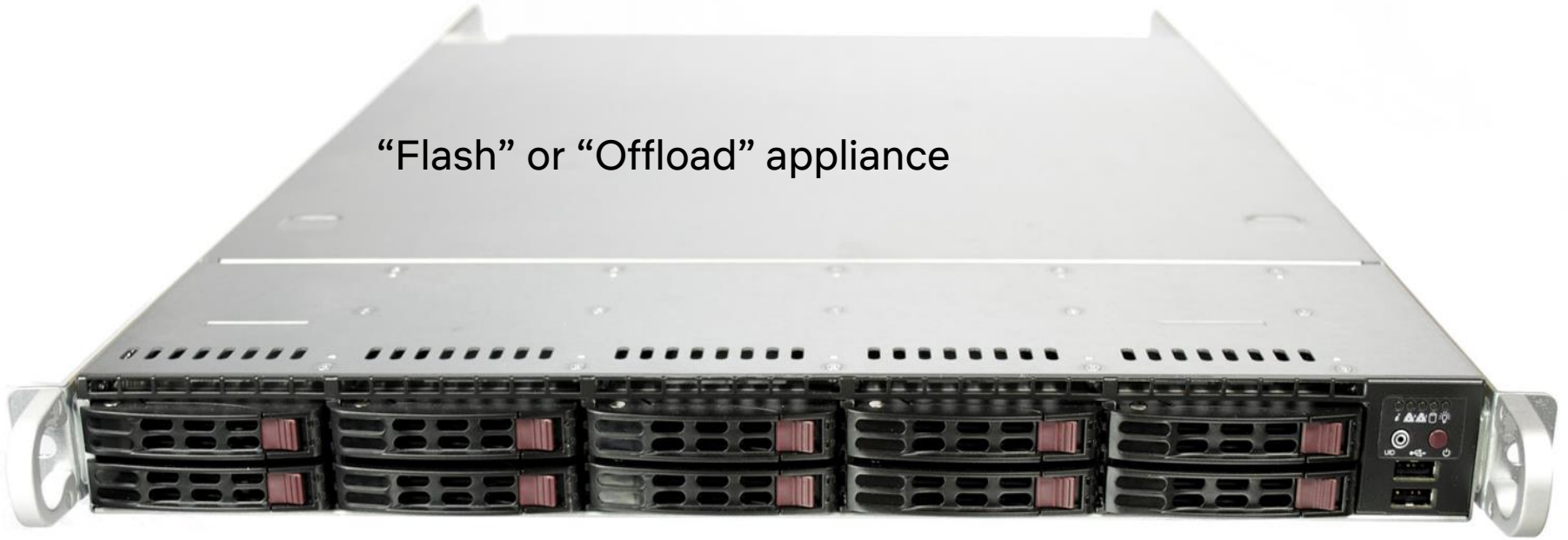


“Storage” appliance

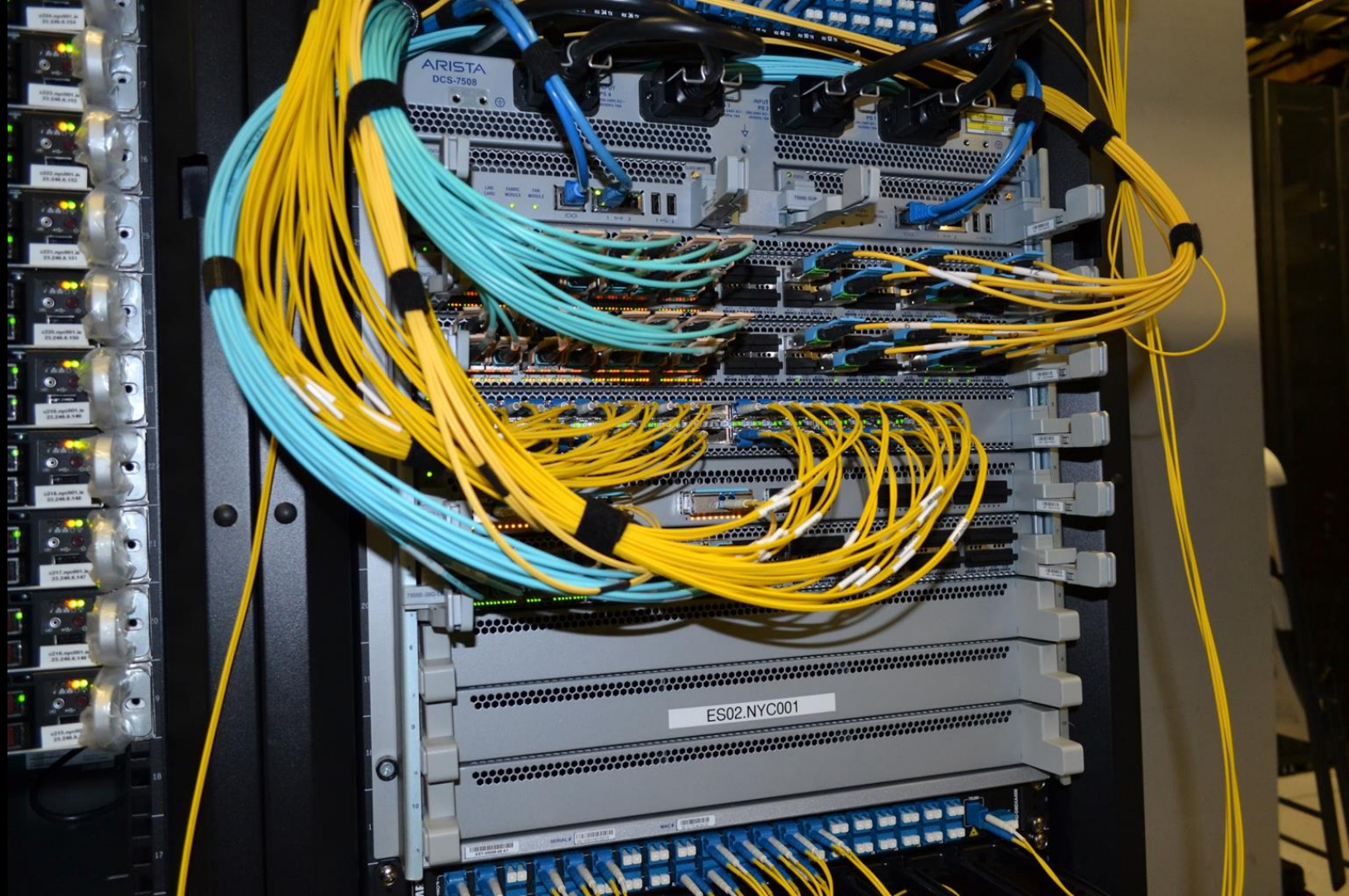


Designed for bulk storage of the entire large regional content catalogs

“Flash” or “Offload” appliance



High-throughput servers, used to serve very popular content





Open Connect

connects directly to

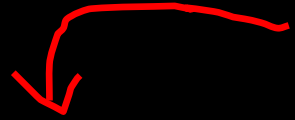
residential ISP networks.

95% of our traffic is directly
connected.

We provide *free*
Open Connect Appliances
for Internet Service
Provider (ISP) data centers

We also provide
interconnection to ISPs at
Internet Exchange locations
throughout the world

wait, what's an IXP?



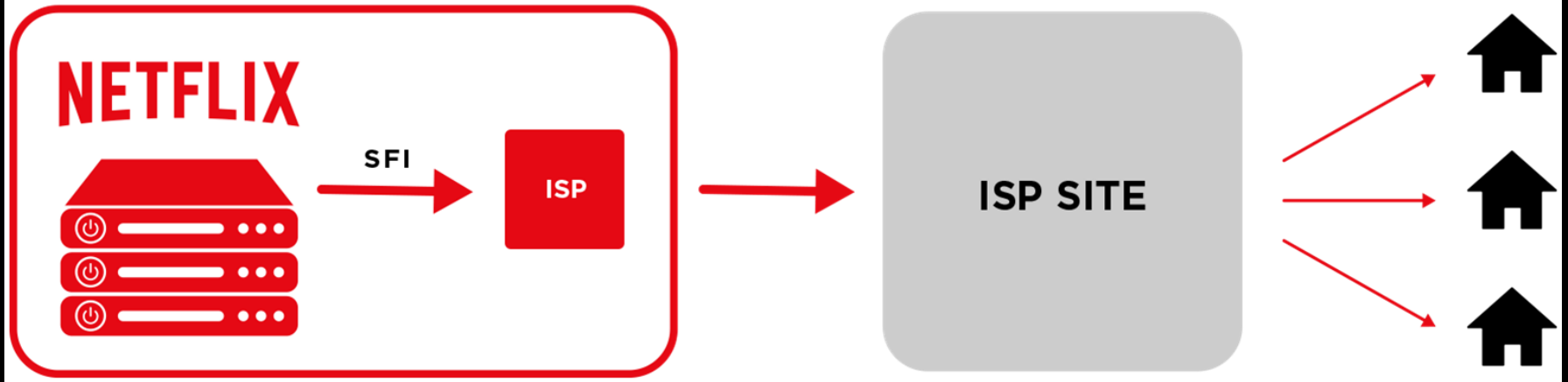
An Internet exchange point
(IX or IXP) is
a physical infrastructure
through which
Internet Service
Providers (ISPs)
and
Content Delivery
Networks (CDNs)
exchange Internet traffic
between their networks



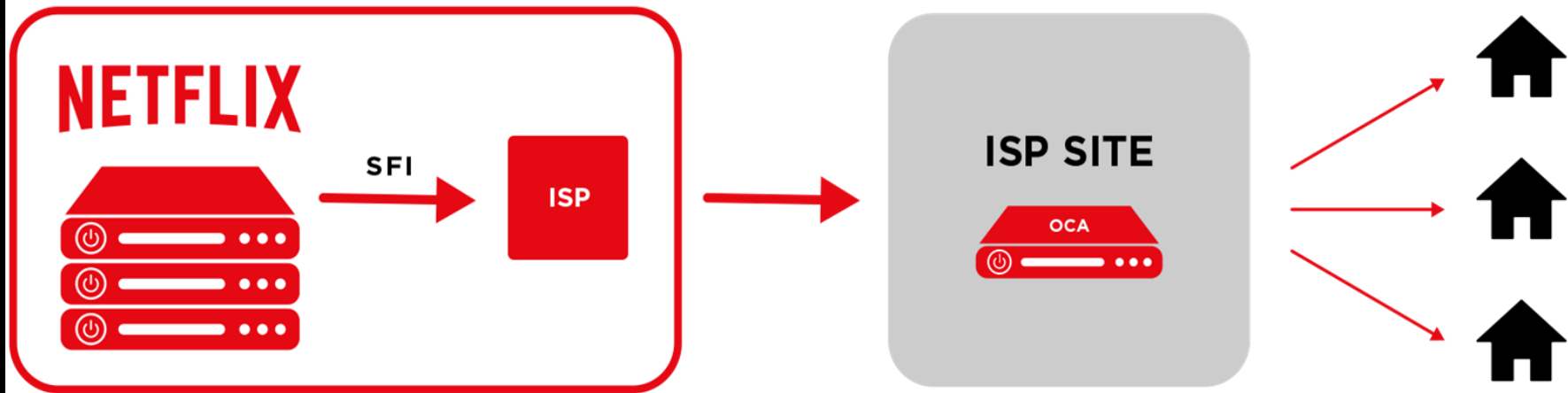
Singapore Equinix SG3



IX SITE

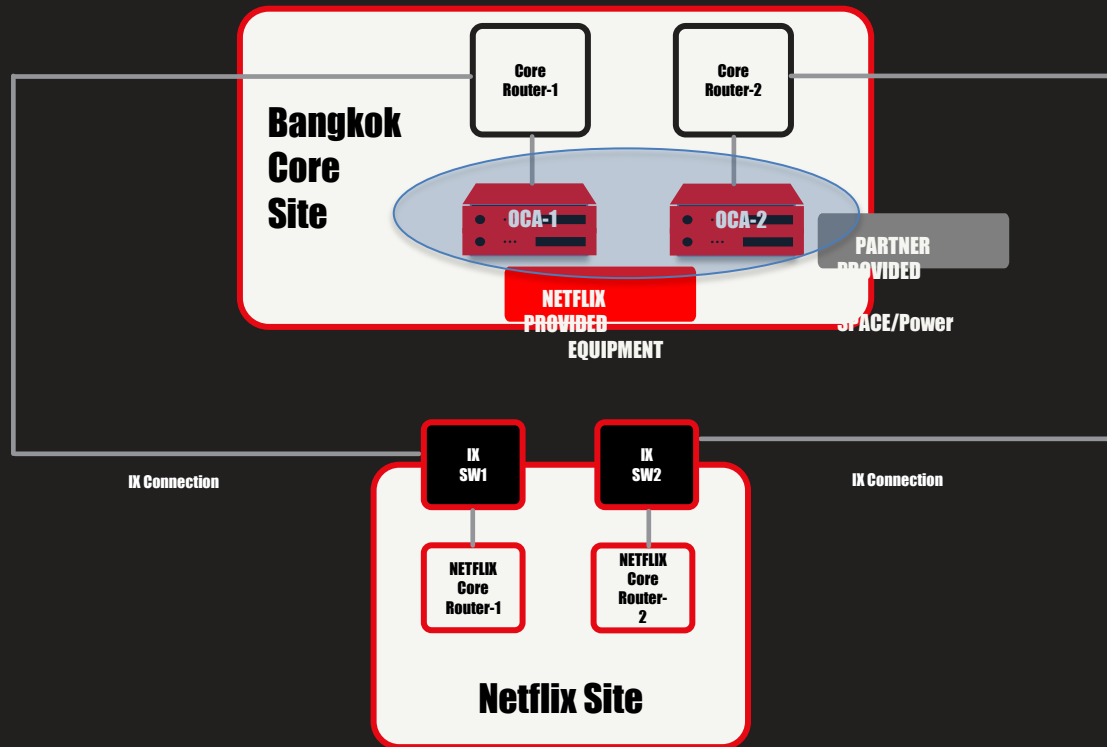


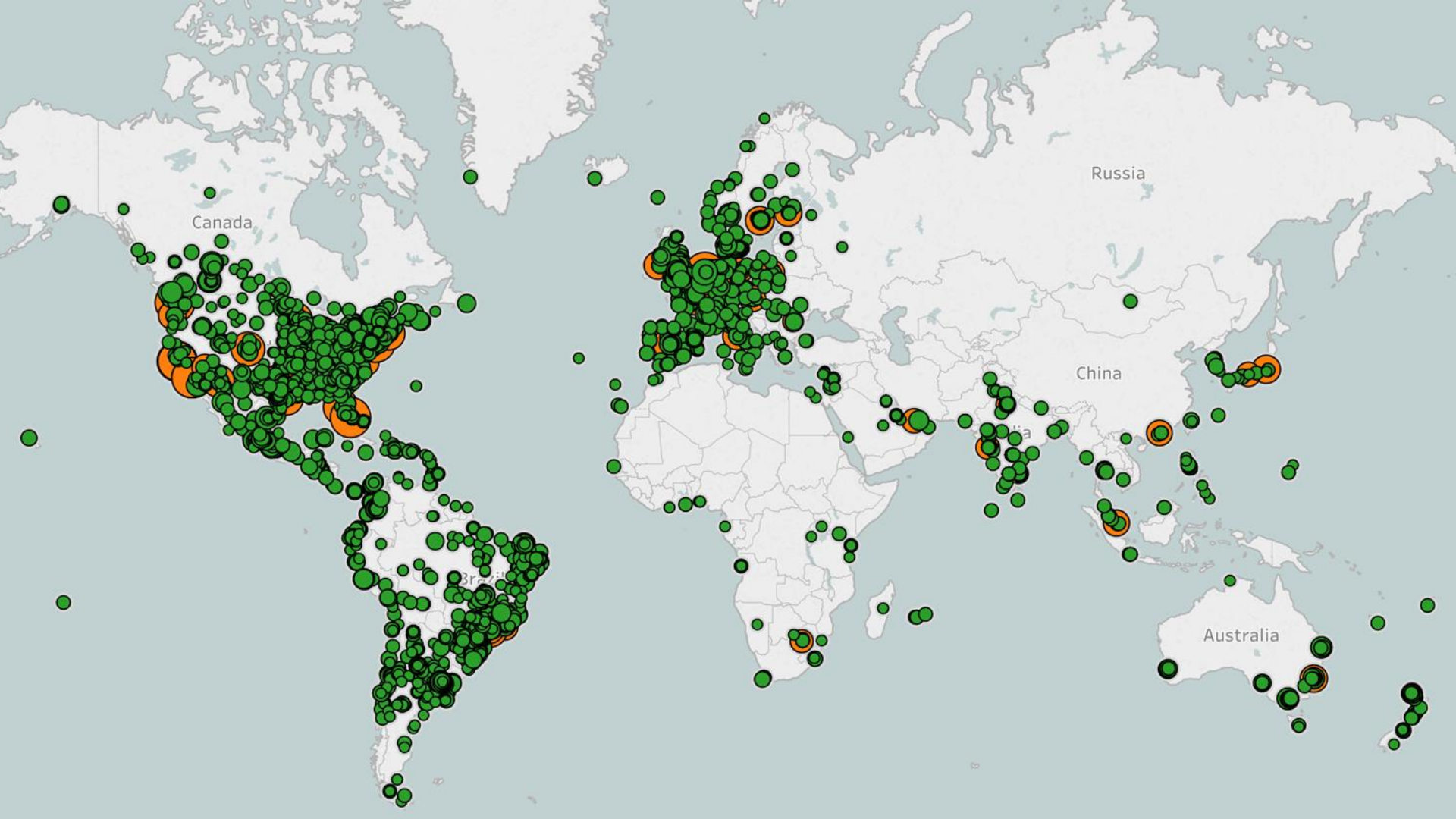
IX SITE



Single CORE Sample Configuration

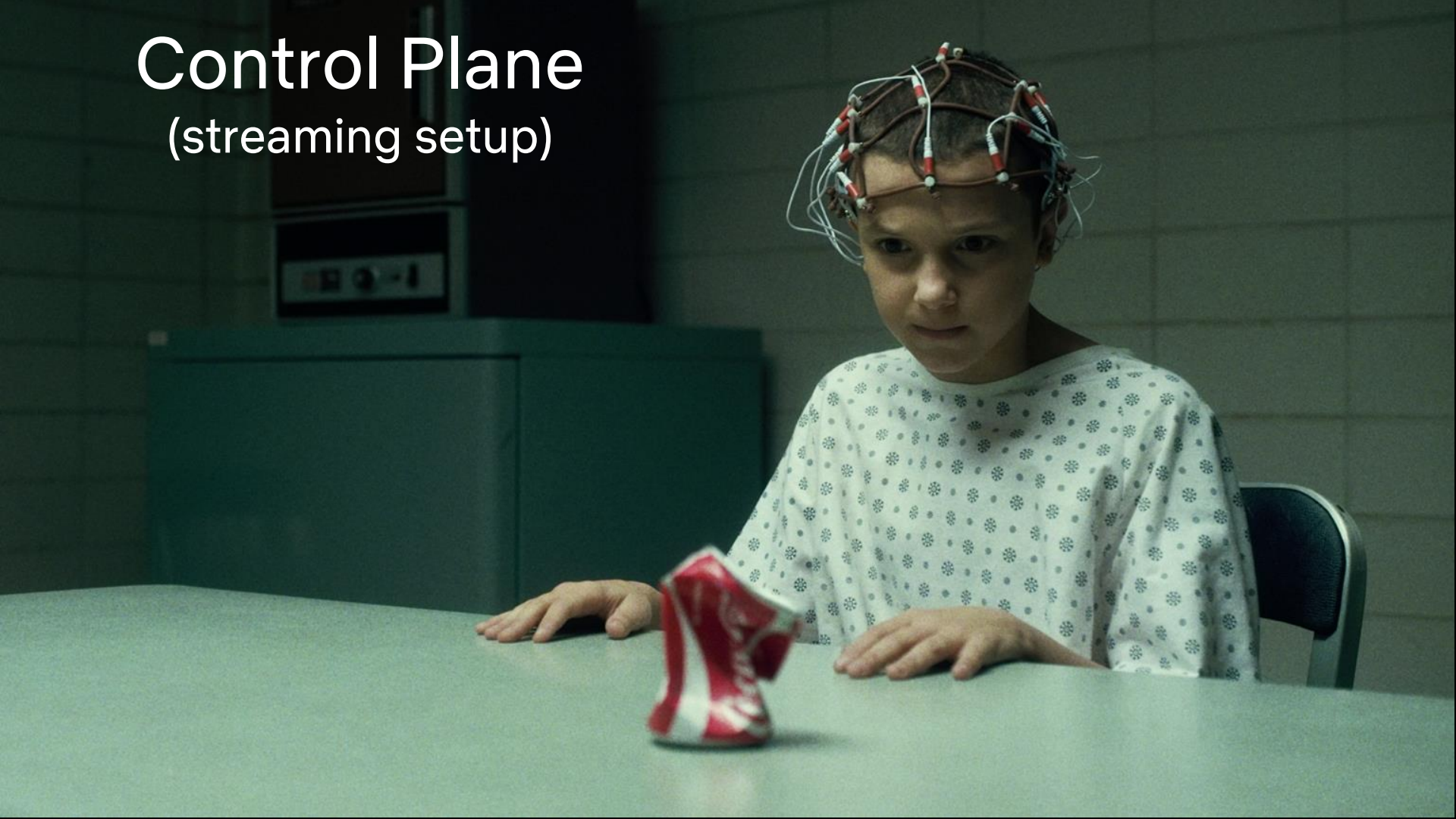
- 1 Site, 2 OCAs in a redundant configuration
- OCAs can be clustered for cache fill
- Connections to 2 Core Routers





Control Plane

(streaming setup)



NETFLIX

Browse ▾

Kids

DVD

Search



Emily ▾

NETFLIX ORIGINAL
STRANGER THINGS

★★★★★ 2016 TV-14 1 Season

Resume

S1:E8 "Chapter Eight: The Upside Down"

52 of 54m

Dr. Brenner holds Hopper and Joyce for questioning while the boys wait with Eleven in the gym. Back at Will's, Nancy and Jonathan prepare for battle.

+ MY LIST

OVERVIEW

EPISODES

TRAILERS & MORE

MORE LIKE THIS

DETAILS

Determine the preferred experience

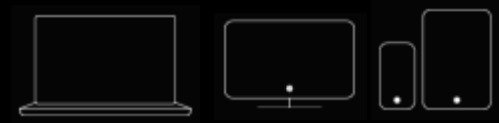
TITLE



LOCATION



DEVICE



LANGUAGE



- | | |
|--|------------------------------------|
| <input type="radio"/> Dansk | <input type="radio"/> Norsk bokmål |
| <input type="radio"/> Deutsch | <input type="radio"/> Português |
| <input checked="" type="radio"/> English | <input type="radio"/> Suomi |
| <input type="radio"/> Español | <input type="radio"/> Svenska |
| <input type="radio"/> Français | <input type="radio"/> 日本語 |
| <input type="radio"/> Nederlands | |

NETWORK



Broadband - wired or
wifi
Cellular - Edge, 3G,
LTE, ...

CONNECTIONS



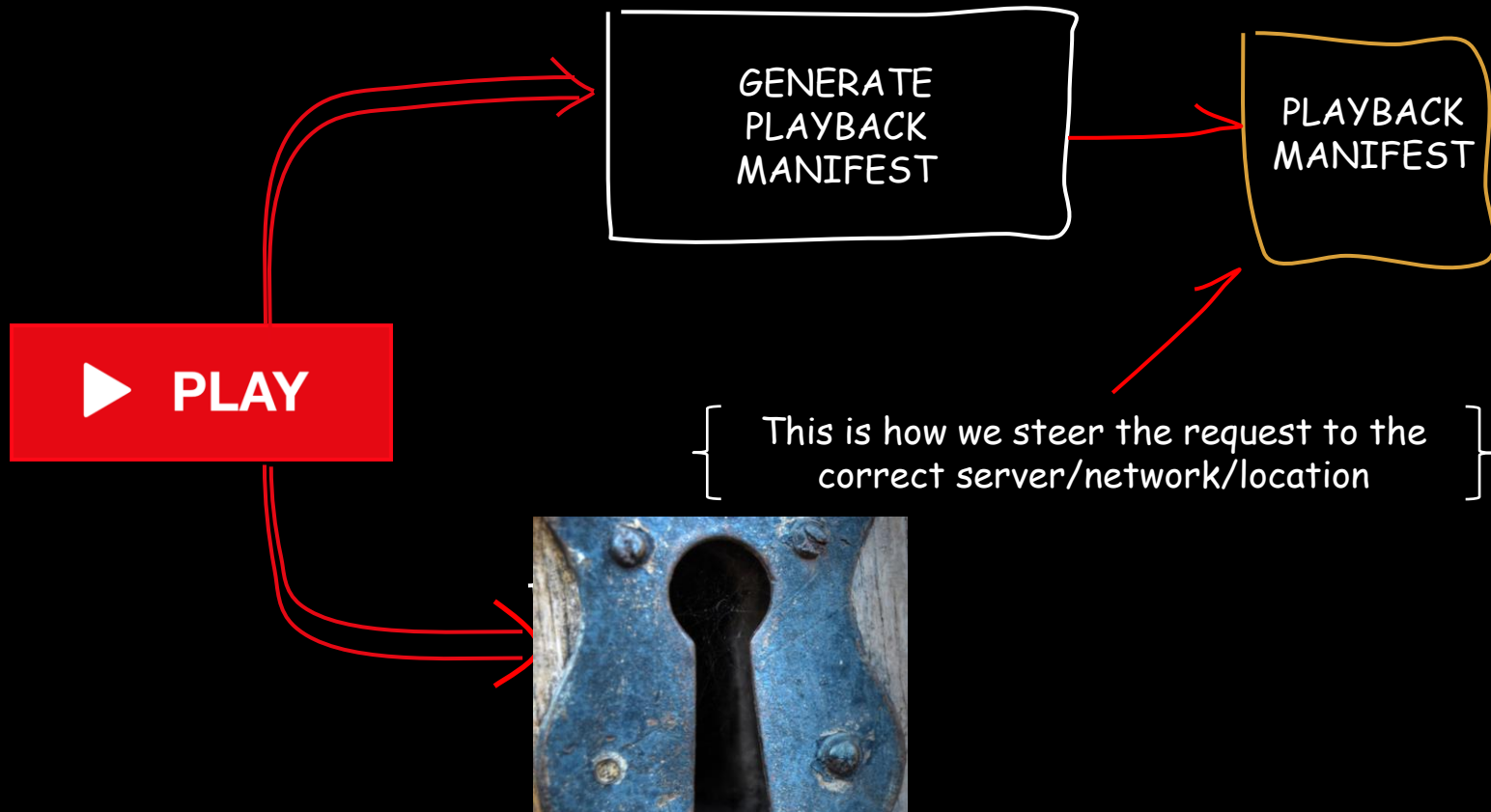
HDPC support,
etc.

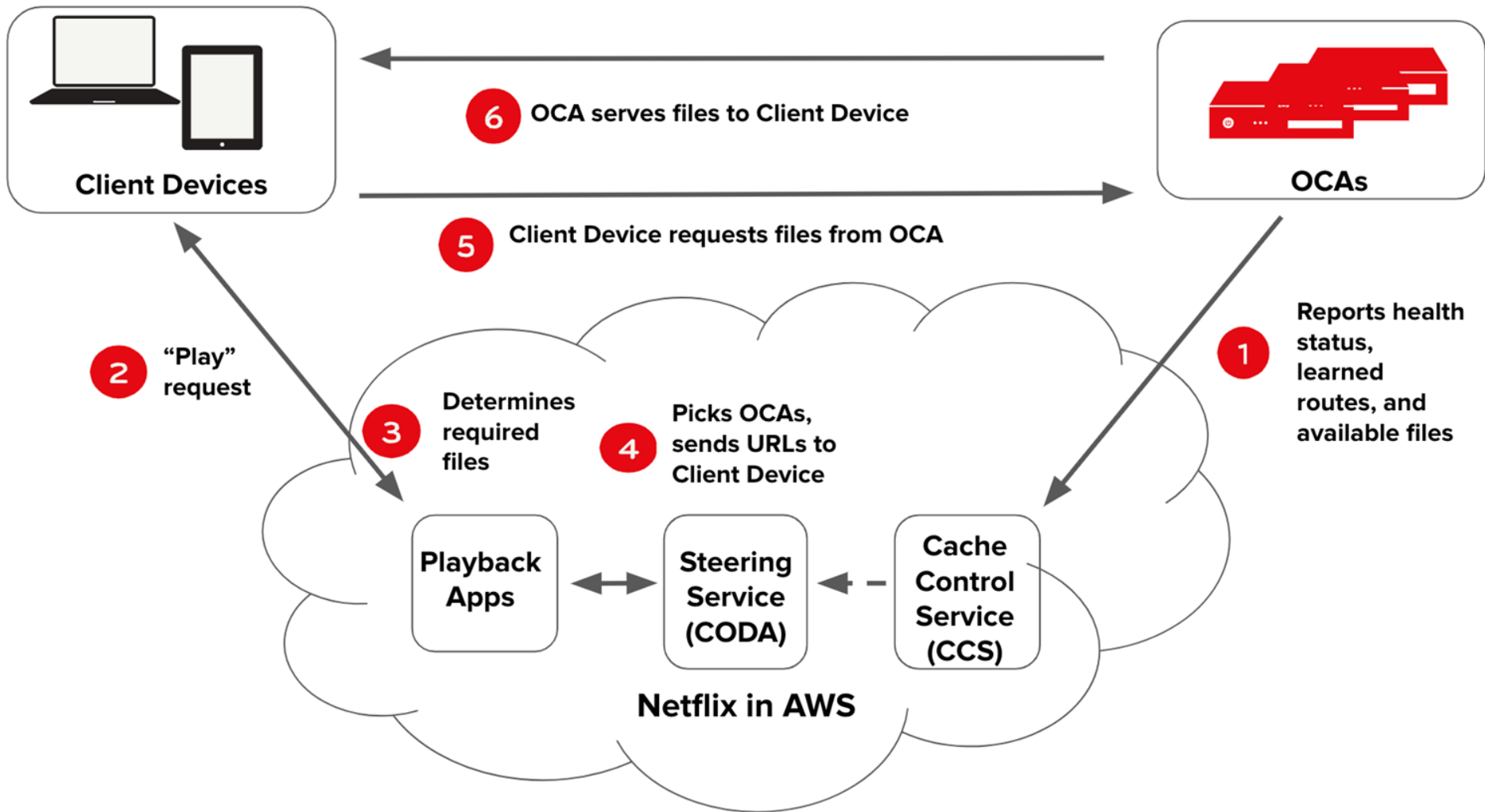
That's exactly what I want

...now
where can I
get it?



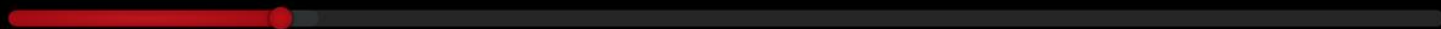
PLAYBACK







STRANGER THINGS



39:13



Stranger Things Season 1: Ep. 1 Chapter One: The Vanishing Of Will Byers



Content
Filling

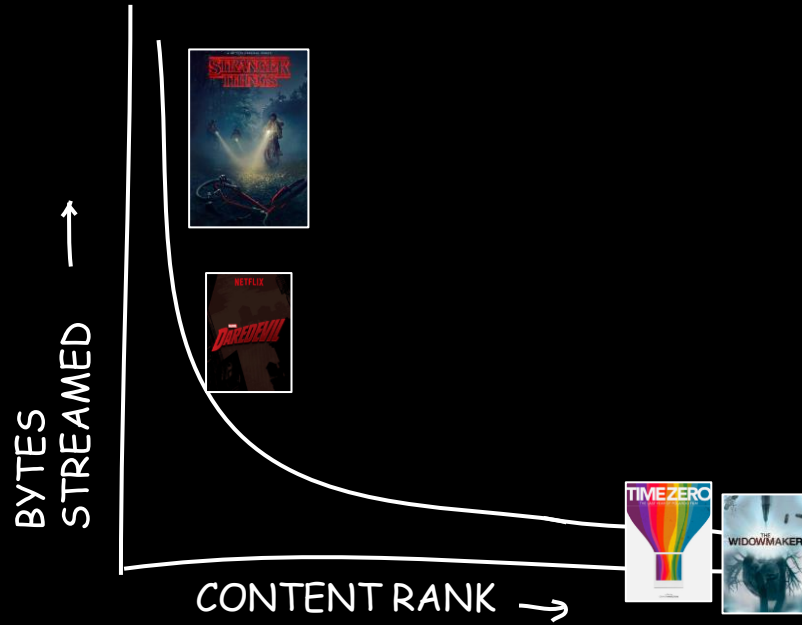
pre-
positioning



Caches fill while
you sleep

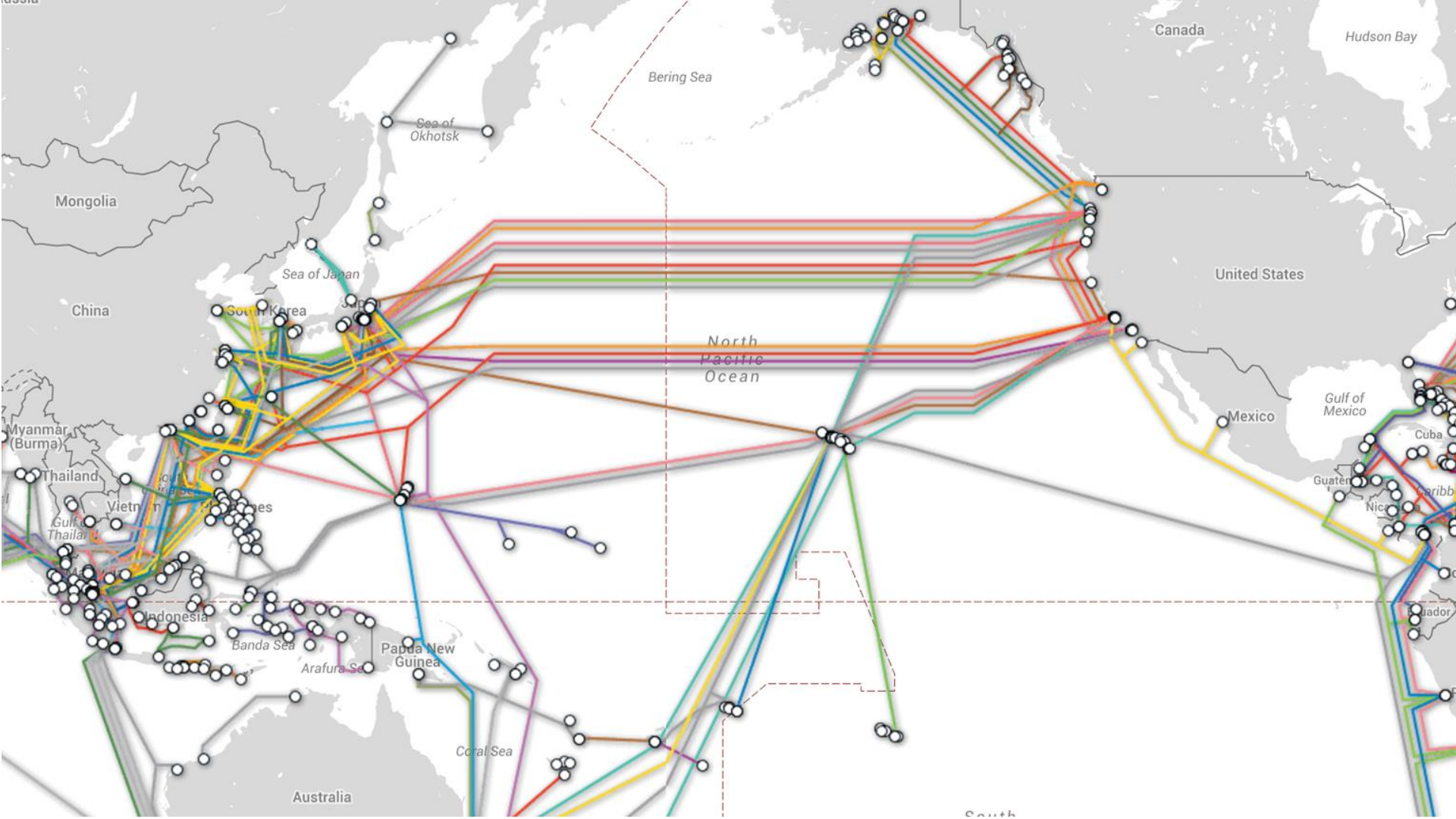


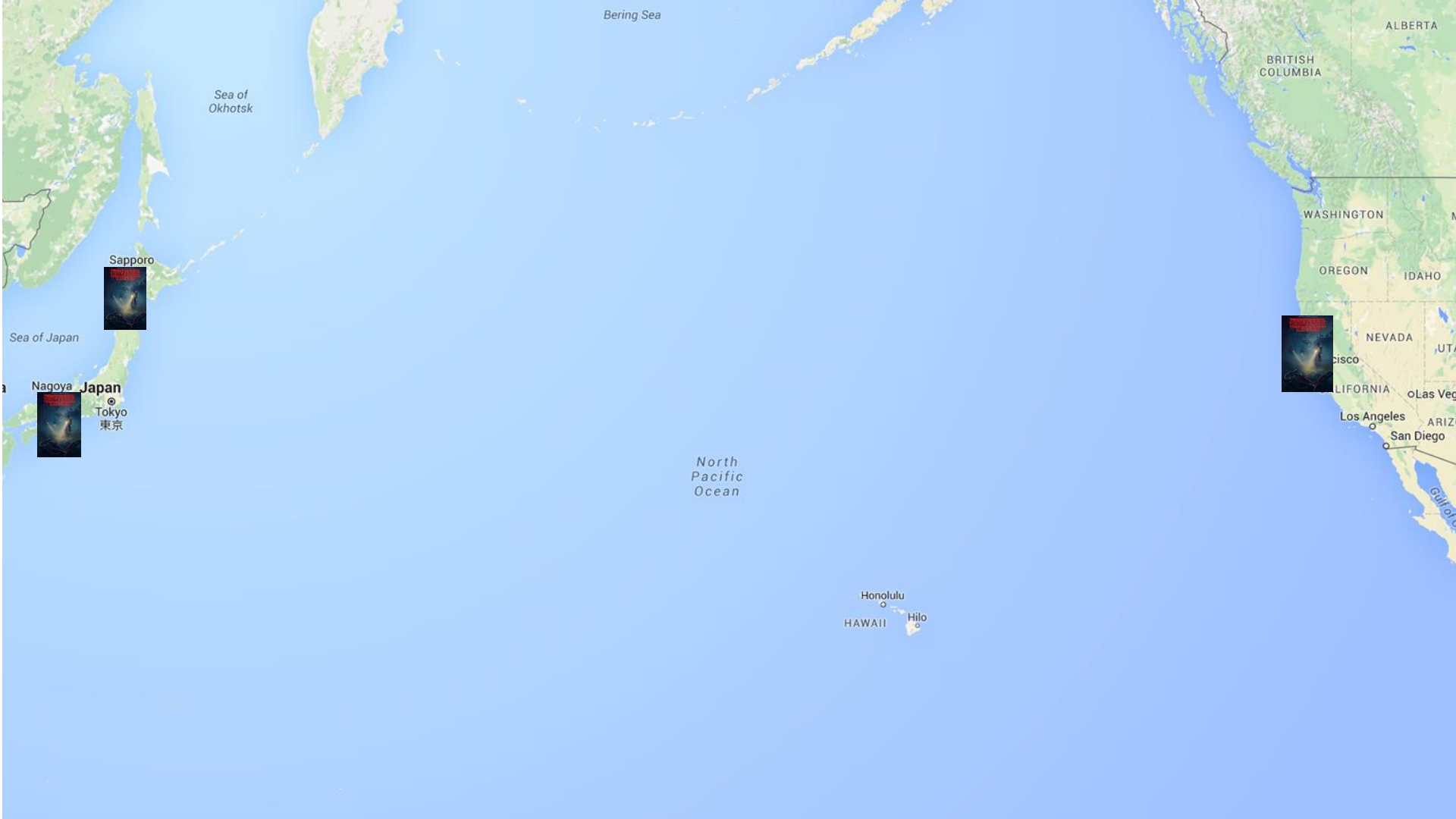
Files are copied *off-peak*
(in the middle of the night)
when networks are not
loaded, using pre-
positioning algorithms



PREDICTABLE VIEWING PATTERNS

Using the purpose-built
Open Connect network,
we can copy each new **Netflix**
show into a region *once*, then
show it *thousands or millions* of
times.





Bering Sea

Sea of Okhotsk

Sea of Japan

Sapporo

Nagoya Japan
Tokyo
東京

ALBERTA

BRITISH COLUMBIA

WASHINGTON

OREGON

IDAHO

NEVADA

UTAH

CALIFORNIA

Las Vegas

Los Angeles

ARIZONA

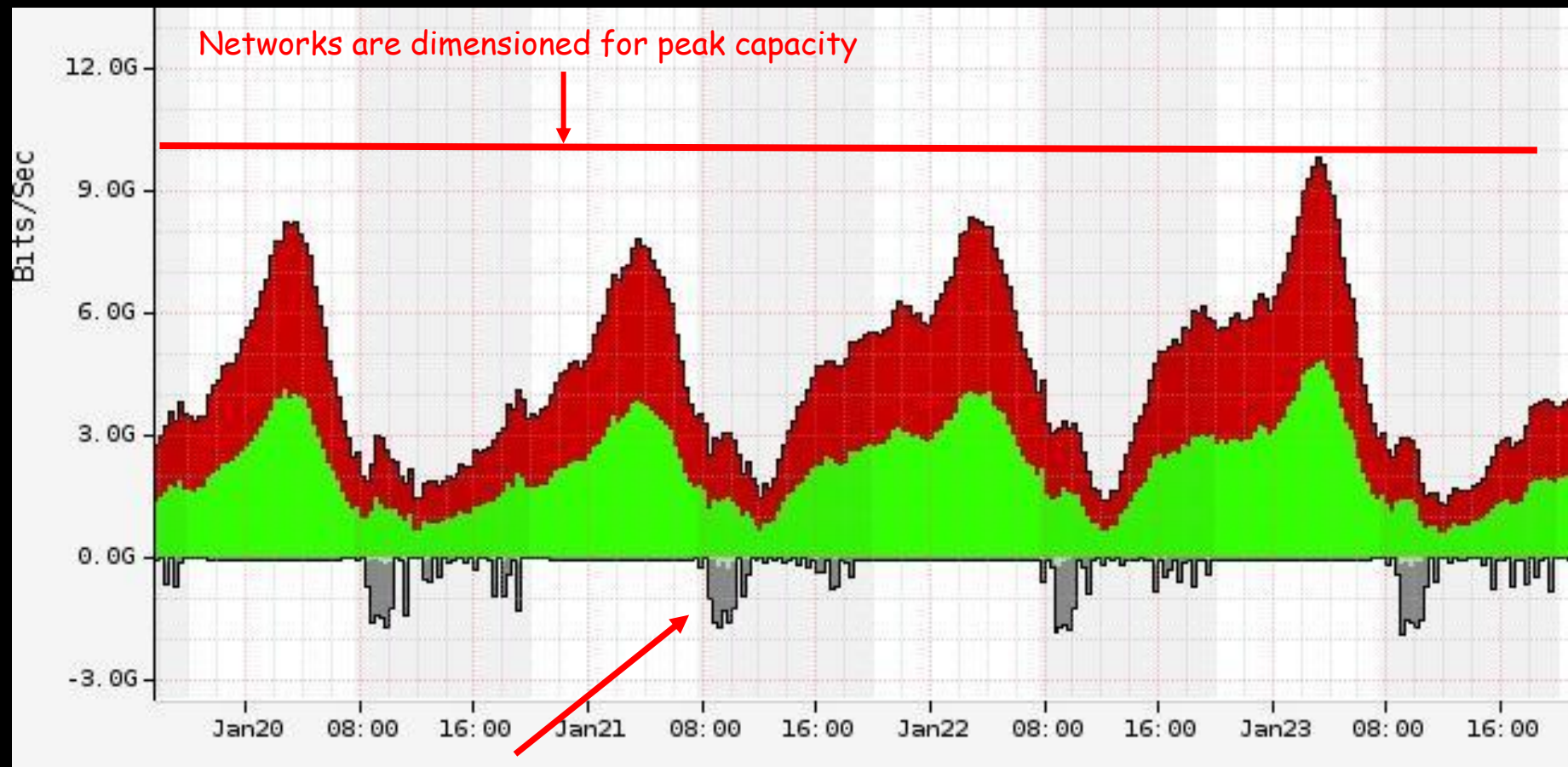
San Diego

Gulf of California

North Pacific Ocean

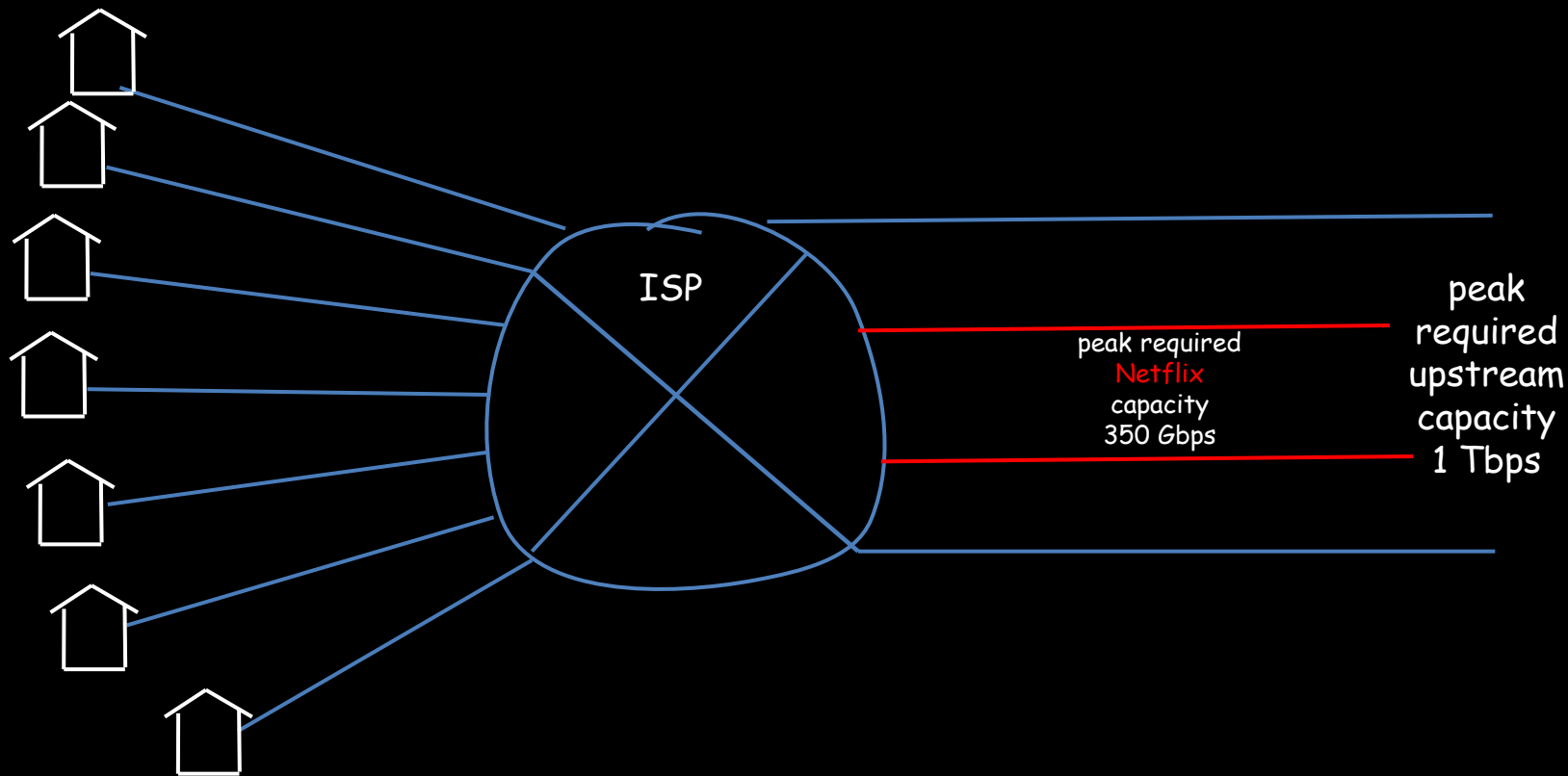
Honolulu
HAWAII
Hilo

Networks are dimensioned for peak capacity

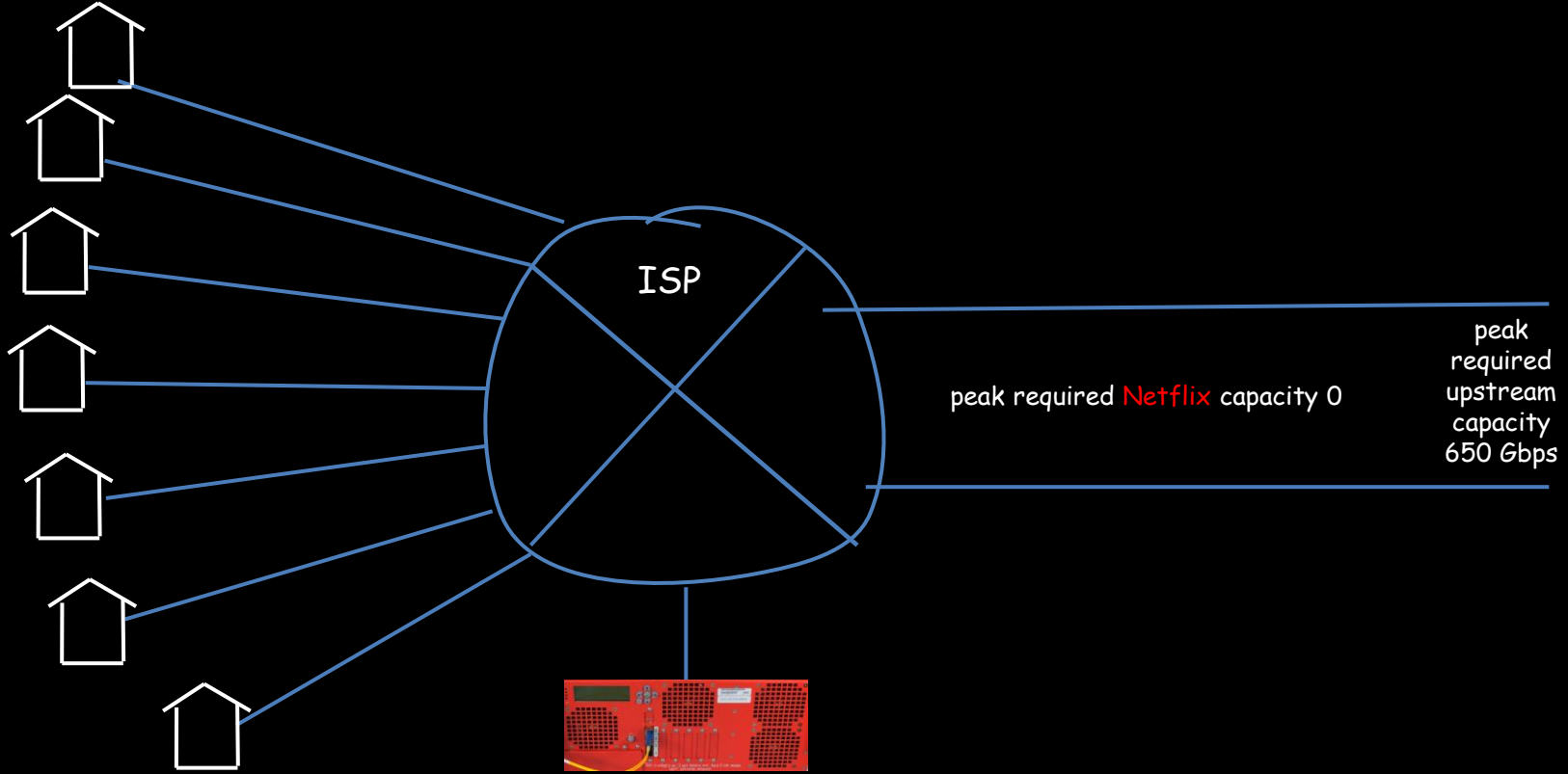


Off-peak cache fill is "free"

ISP customer homes



ISP customer homes

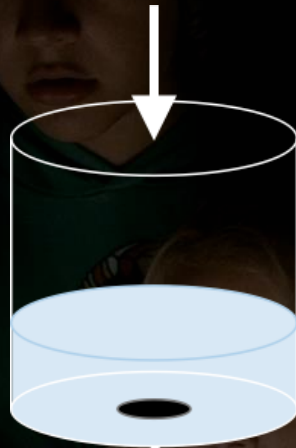


A dark, atmospheric photograph of three people wearing hooded raincoats, standing in the rain at night. They are holding bright flashlights, which create strong lens flares and illuminate the scene. The background is dark and blurry, suggesting a forest or wooded area. The overall mood is mysterious and suspenseful.

Insight into performance
Quality of Experience

input rate (from network)

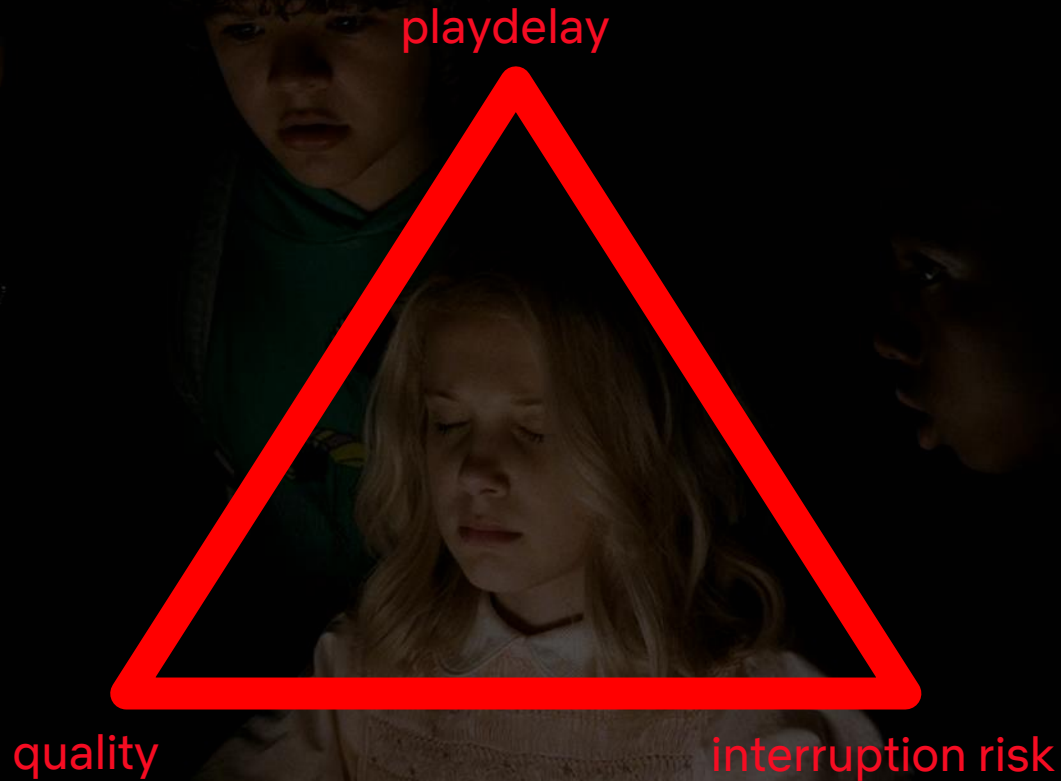
video buffer
(leaky bucket)



buffer level

output rate (to screen)

The Tradeoff



<https://openconnect.netflix.com>



Questions?

A dark, grainy image featuring three children. On the left, a girl with dark hair and bangs looks down. In the center, a boy with curly hair and a green shirt looks down. In the foreground, a girl with blonde hair and a white lace-trimmed dress looks down. The text "Thank you!" is overlaid in red in the center. The background is mostly black, with some faint details of the children's clothing and a small object on the right.

Thank you!