

Netflix Open Connect Delivery Architecture

Jocelyn Ooi
Netflix

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DISTRIBUTION

NETFLIX

>109 million members

> 190 countries

> At peak, Netflix streams over 250 Million hours in a single day

A young man with long hair, wearing a dark jacket, is looking upwards with a surprised expression. He is in a room decorated with numerous strings of colorful, multi-colored string lights (red, green, blue, yellow, pink) hanging from the ceiling. The room has wood-paneled walls and a window with white curtains in the background. The overall atmosphere is warm and festive.

How
NETFLIX
Works

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Inventing Internet TV:

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

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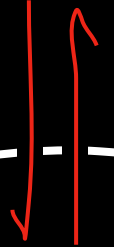
NETFLIX
DEVICE

STREAM

DATA PLANE

Open Connect

[Content
Delivery
Network]



CONTROL PLANE

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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

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before streaming starts = control plane =



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+ MY LIST

OVERVIEW

EPISODES

TRAILERS & MORE

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DETAILS

streaming = data plane = Open Connect

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A young girl with short brown hair, wearing a blue jacket over a light-colored sweater, stands in a rocky, outdoor setting. The background is slightly blurred, showing dark rocks and some greenery.

Data Plane

(streaming playback)

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The poster features a central group of characters in a dark, industrial setting. In the background, a large, close-up face of a young boy with a serious expression is superimposed over a starry night sky. To the left, a woman with brown hair looks on with a concerned expression. In the foreground, three young boys are riding motorcycles with their headlights on. To the right, a man in a fedora hat and a light-colored shirt holds a walkie-talkie. A sign on a fence in the background reads "RESTRICTED AREA NO TRESPASSING U.S. GOVERNMENT PROPERTY". The overall atmosphere is mysterious and suspenseful.

Open Connect

A NETFLIX ORIGINAL

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History

Streaming
Launched
("EHub")
2007

Open Connect
2011

Third Party CDN
2009

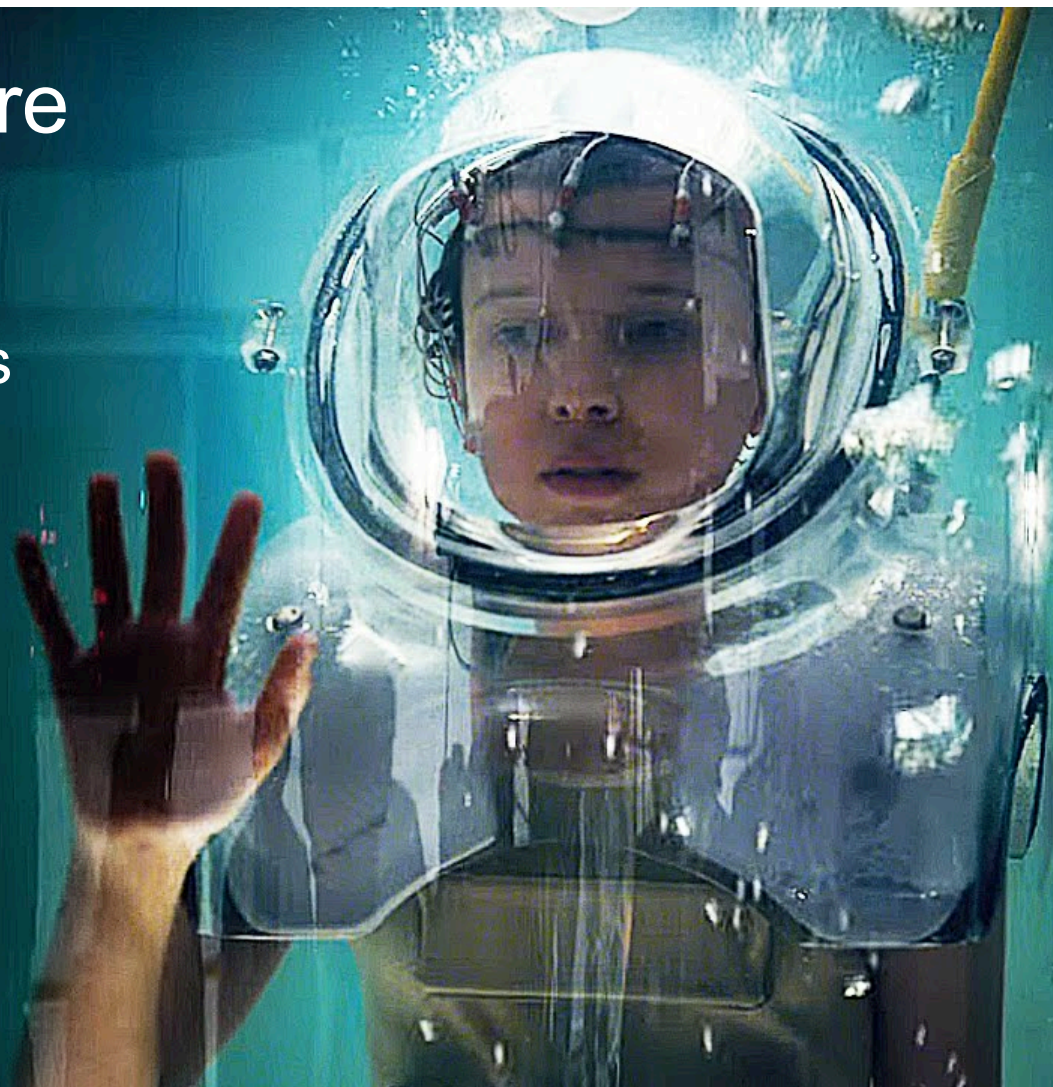
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Hardware

Open

Connect

Appliances



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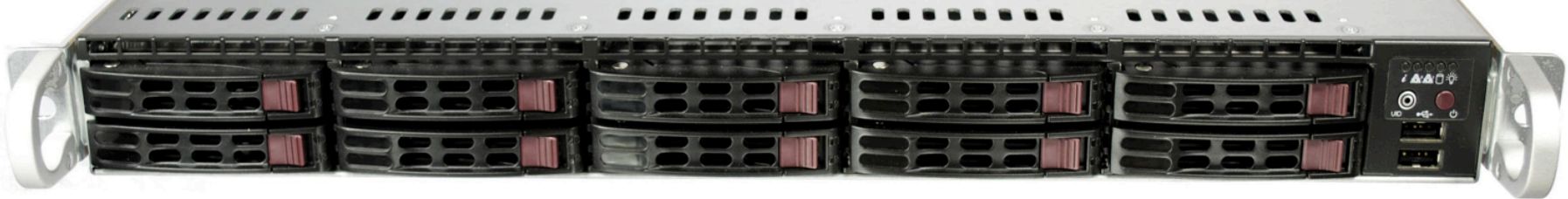
“Storage” appliance



Designed for bulk storage of the entire large regional content catalogs

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“Flash” or “Offload” appliance



High-throughput servers, used to serve very popular content

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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

-wikipedia

Singapore Equinix SG3





IX SITE

NETFLIX



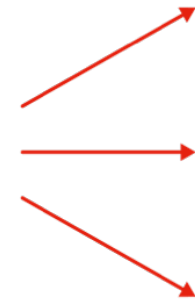
SFI



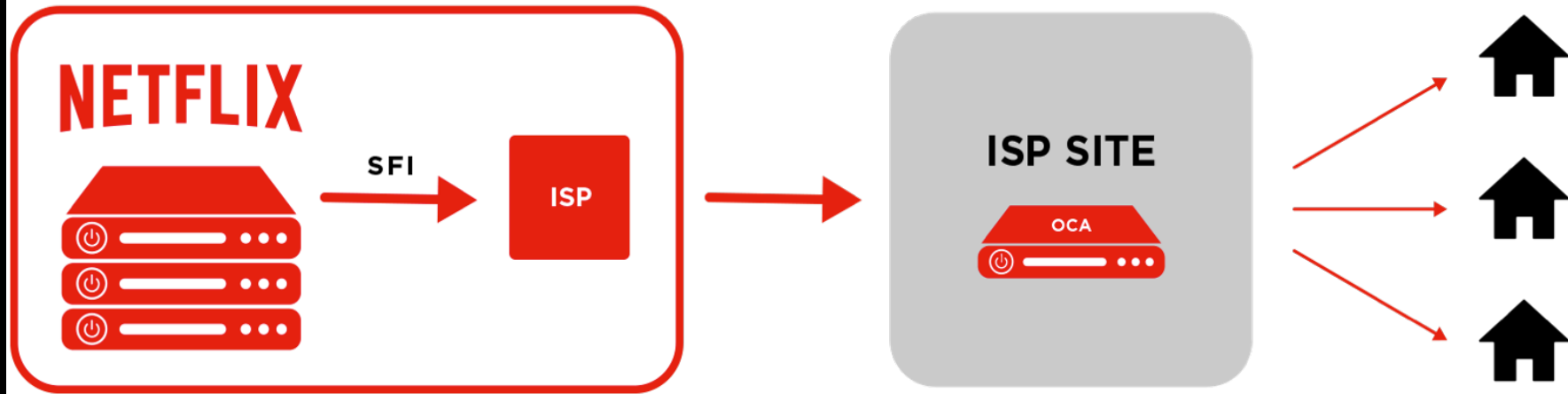
ISP



ISP SITE

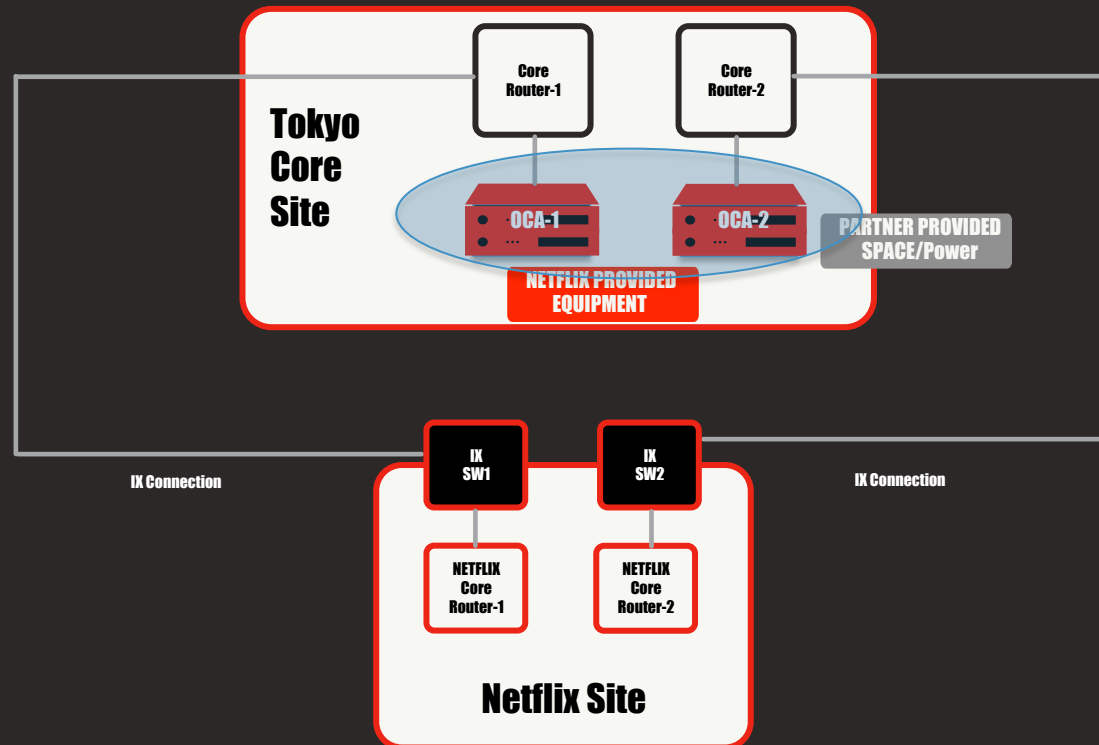


IX SITE

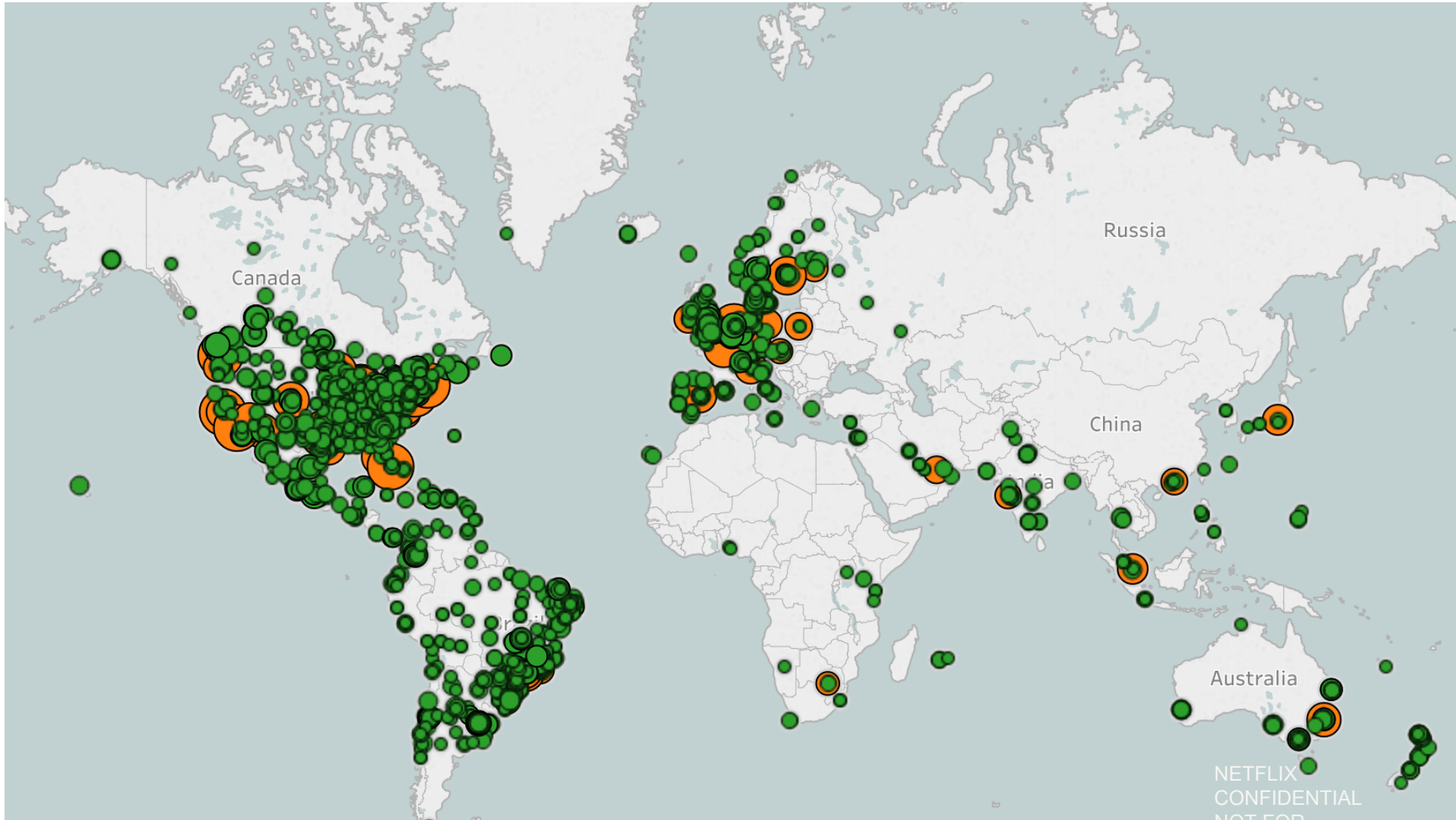


Single CORE Sample Configuration

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

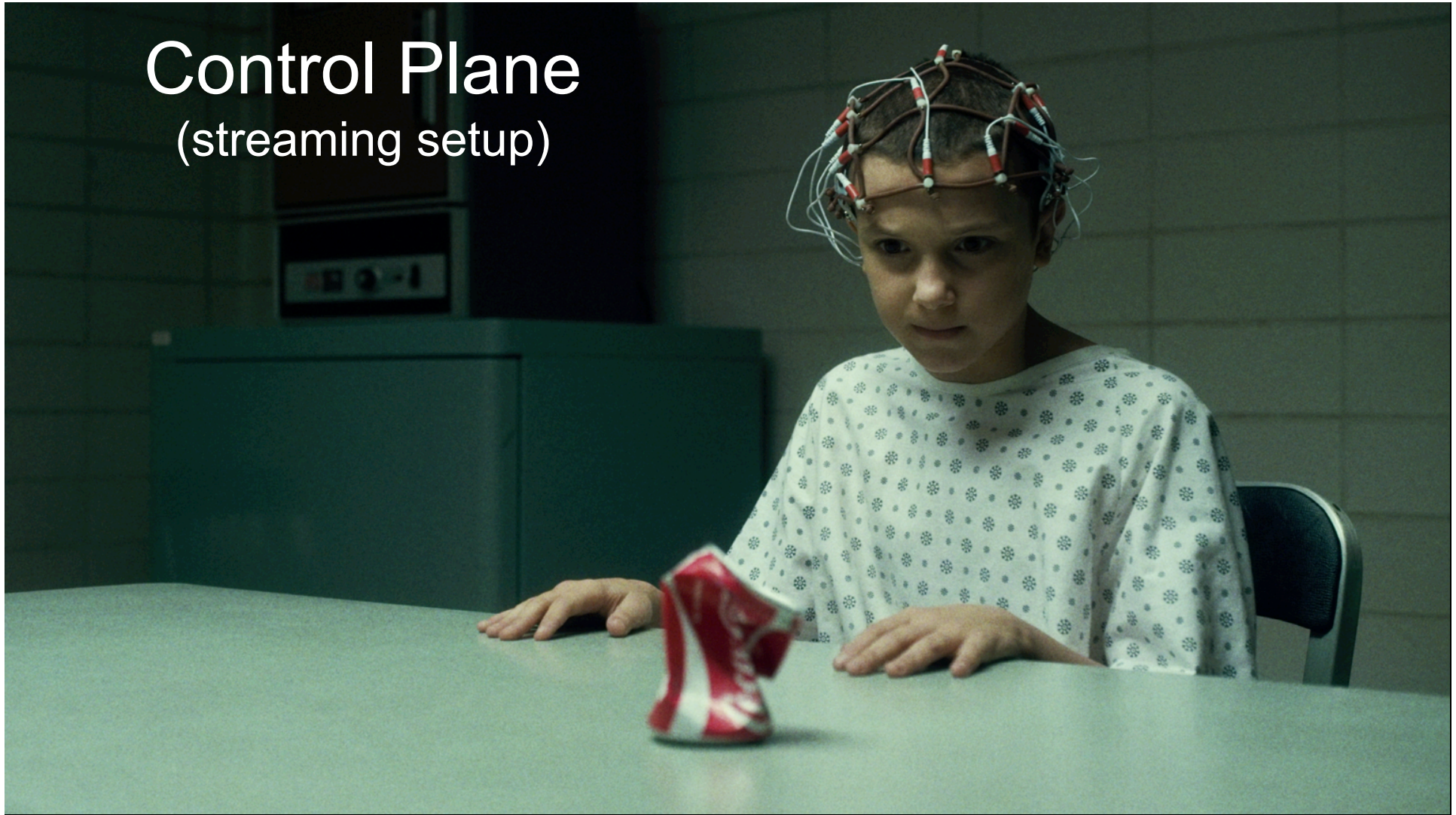


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Control Plane

(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



- Dansk
- Deutsch
- English
- Español
- Français
- Nederlands
- Norsk bokmål
- Português
- Suomi
- Svenska
- 日本語

NETWORK



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

CONNECTIONS



HDCP support, etc.

That's exactly what I want

...now
where can I
get it?



PLAYBACK



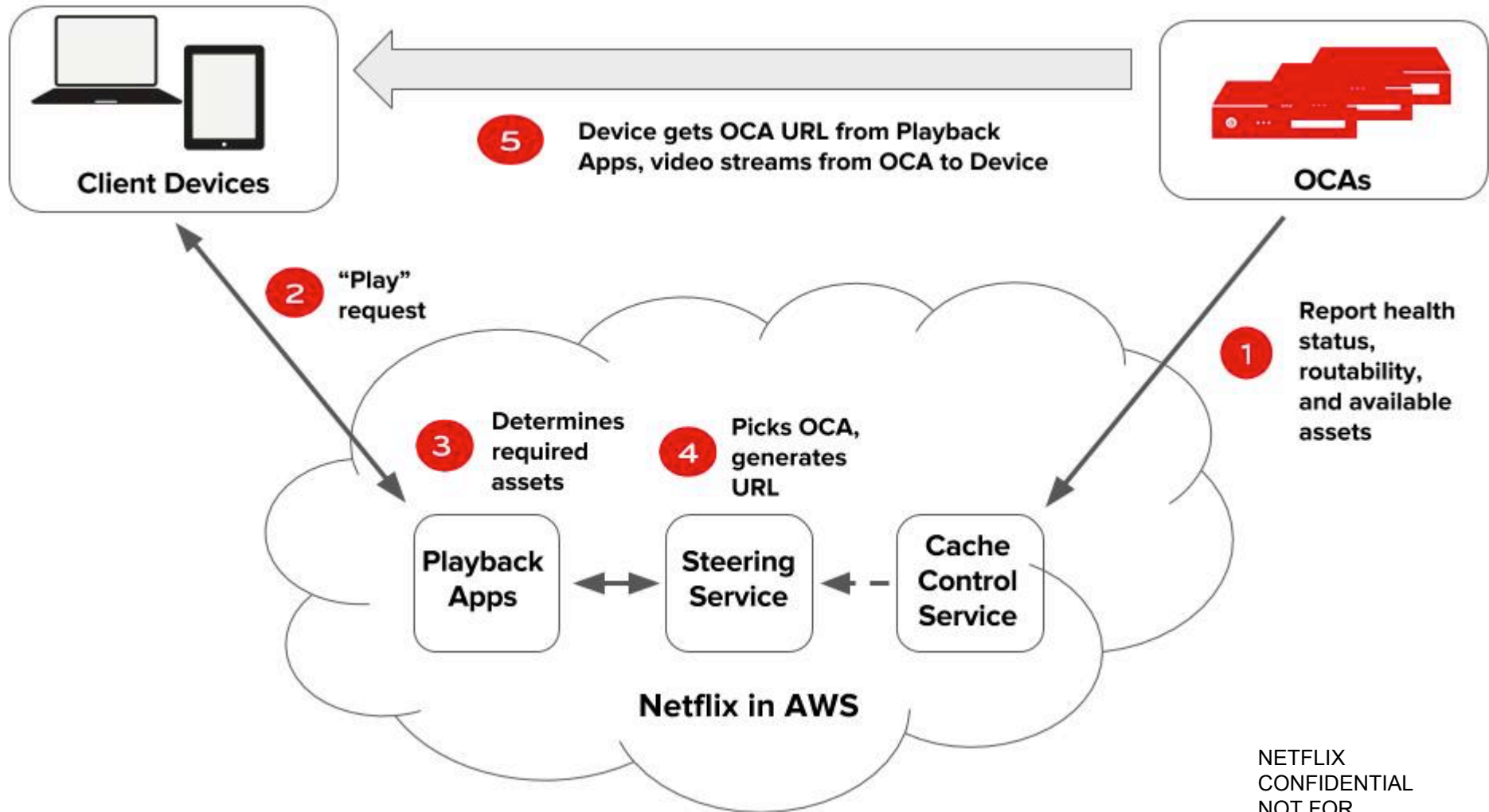
GENERATE
PLAYBACK
MANIFEST

PLAYBACK
MANIFEST

{ This is how we steer the request to the
correct server/network/location }



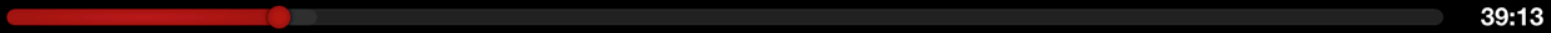
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STRANGER THINGS



39:13

▶ 🔊 Stranger Things Season 1: Ep. 1 Chapter One: The Vanishing Of Will Byers ▶ 📄 💬 🖥️

Content
Filling

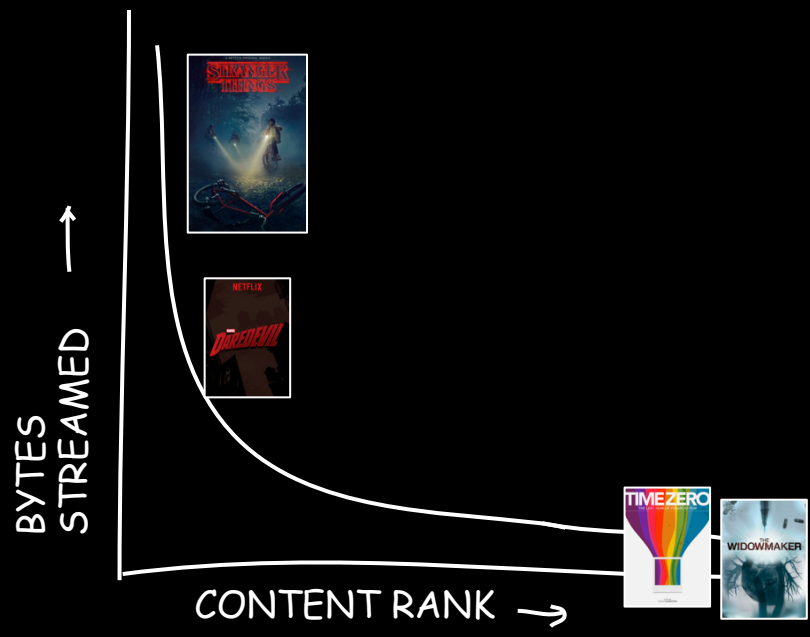
pre-positioning



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

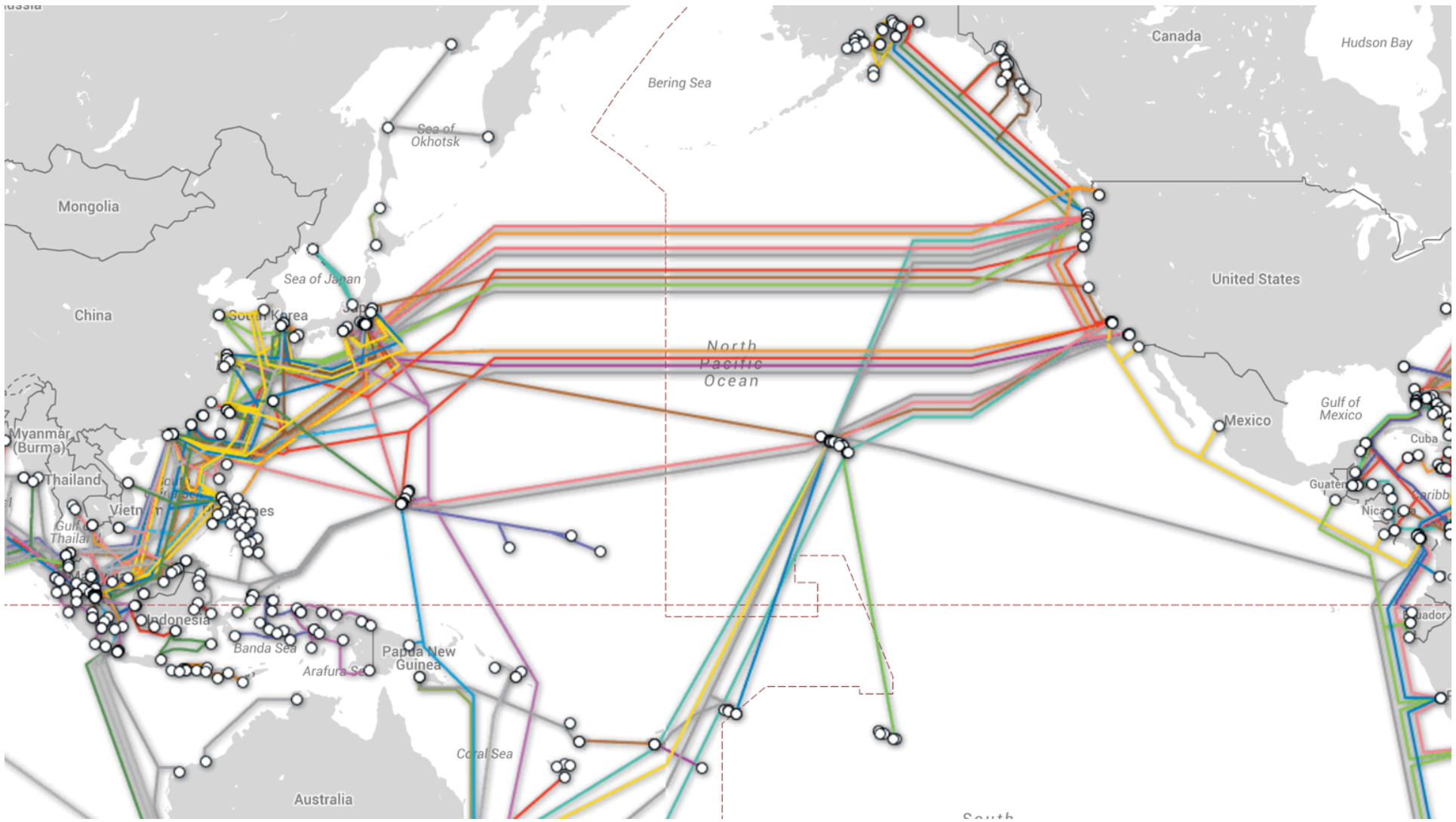


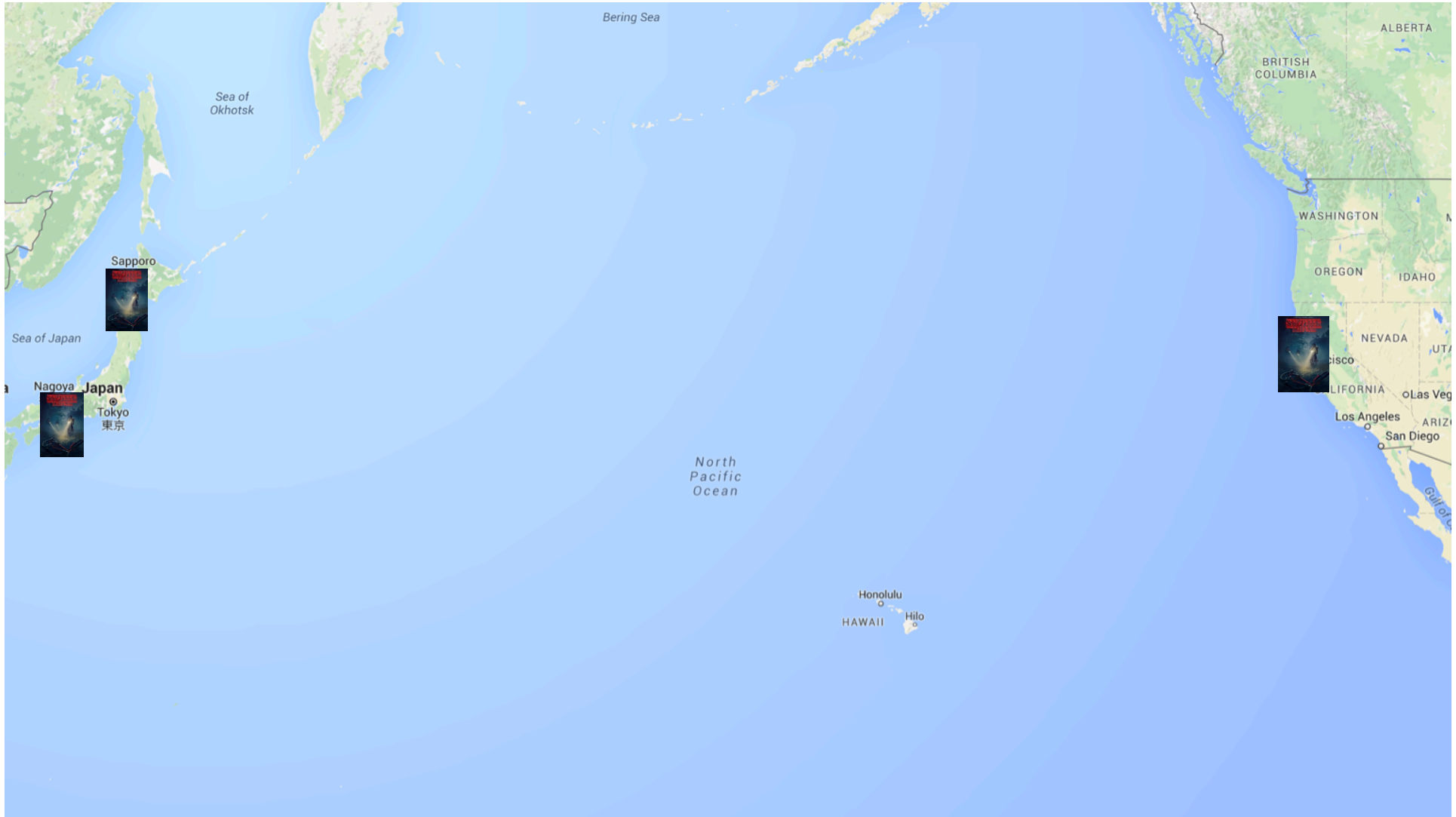
PREDICTABLE VIEWING PATTERNS

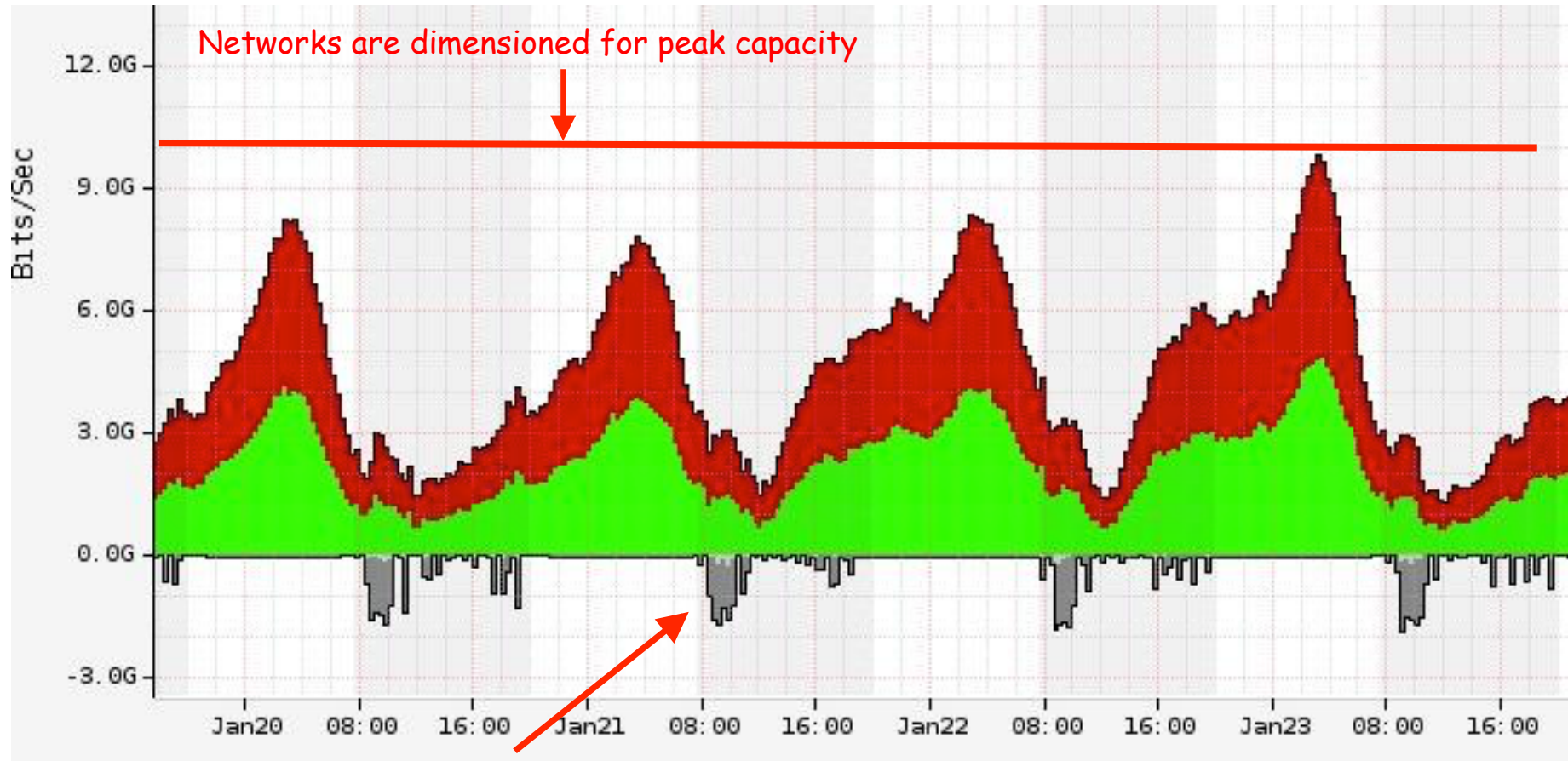
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Using the purpose-built
Open Connect network,
we can copy each new **Netflix**
show into a region *once*, then
show it *thousands or millions* of
times.

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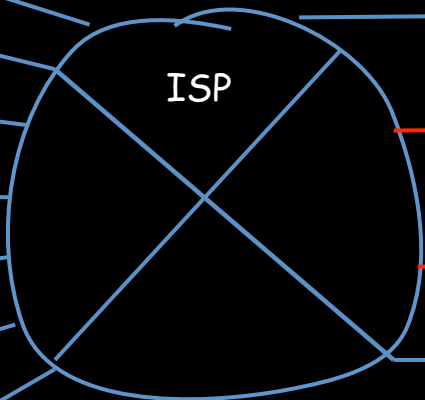
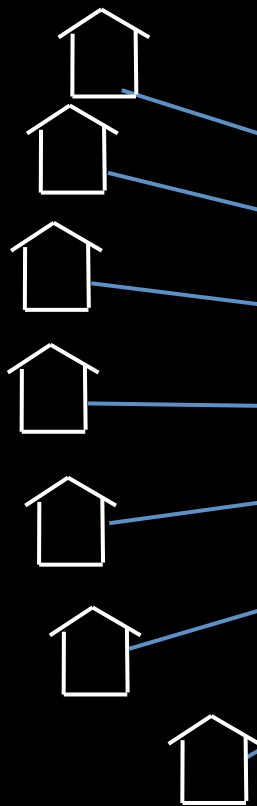






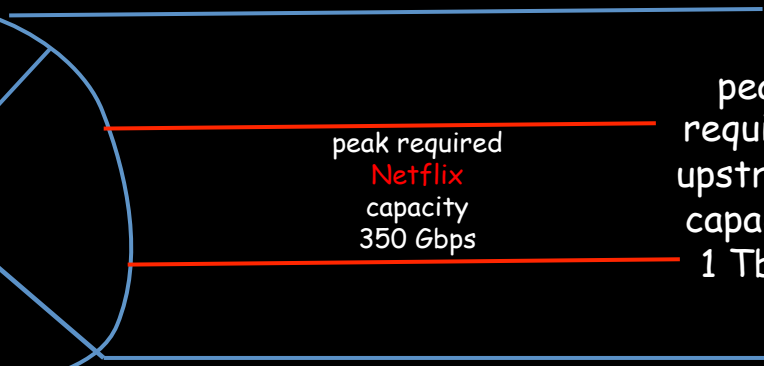
Off-peak cache fill is "free"

ISP customer homes

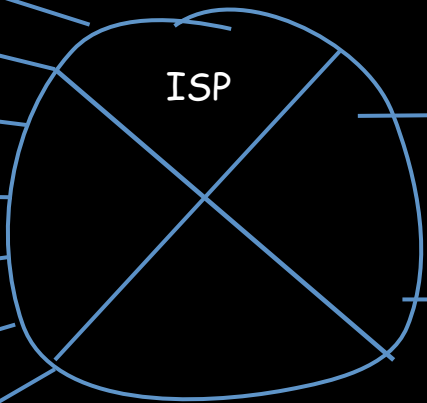
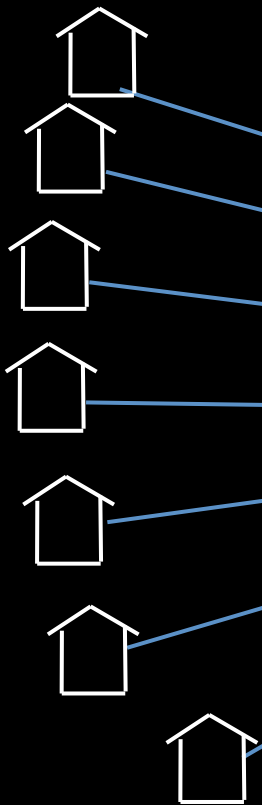


peak required
Netflix
capacity
350 Gbps

peak
required
upstream
capacity
1 Tbps



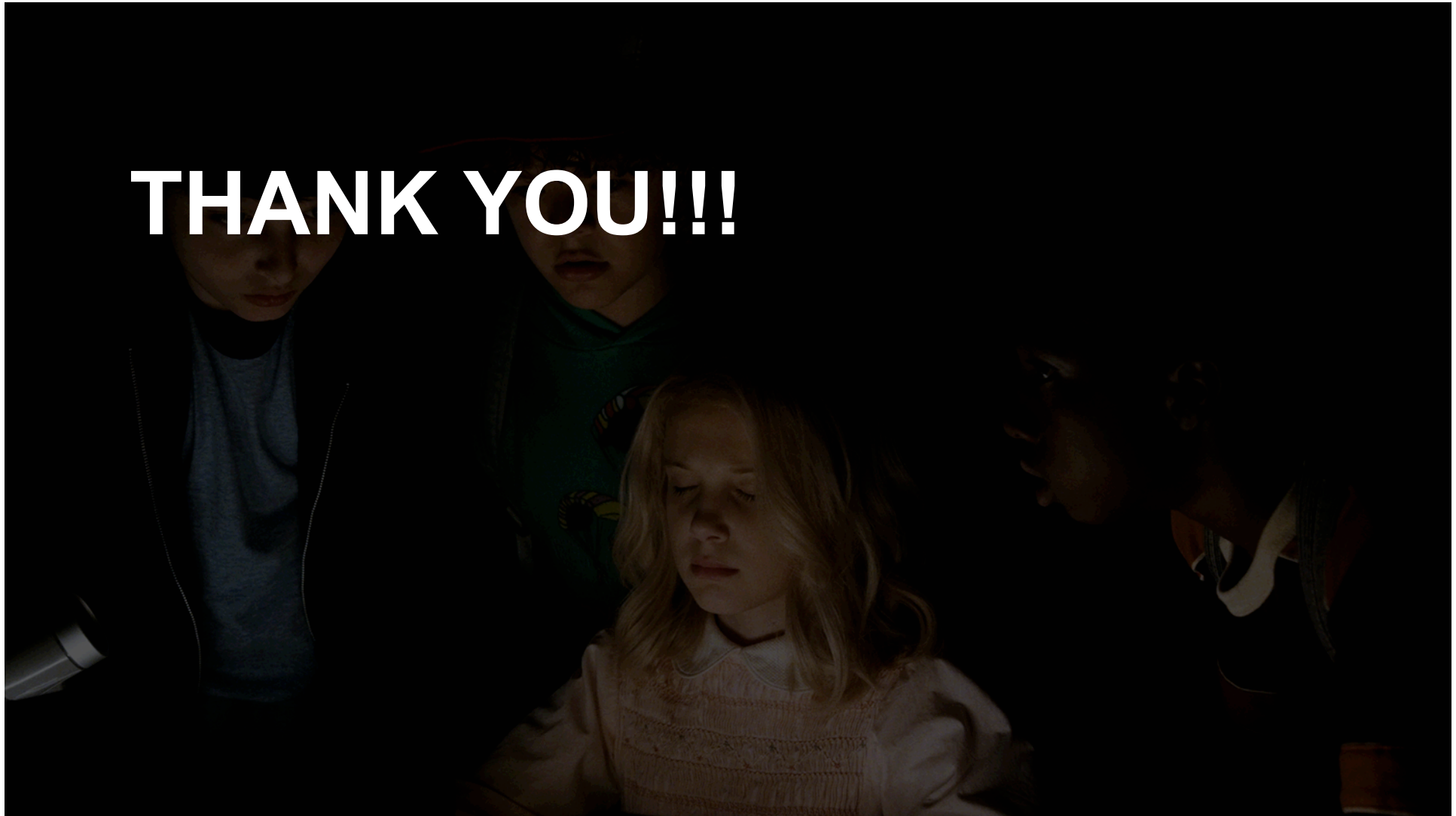
ISP customer homes



peak required Netflix capacity 0

peak required upstream capacity 650 Gbps

THANK YOU!!!





Questions?