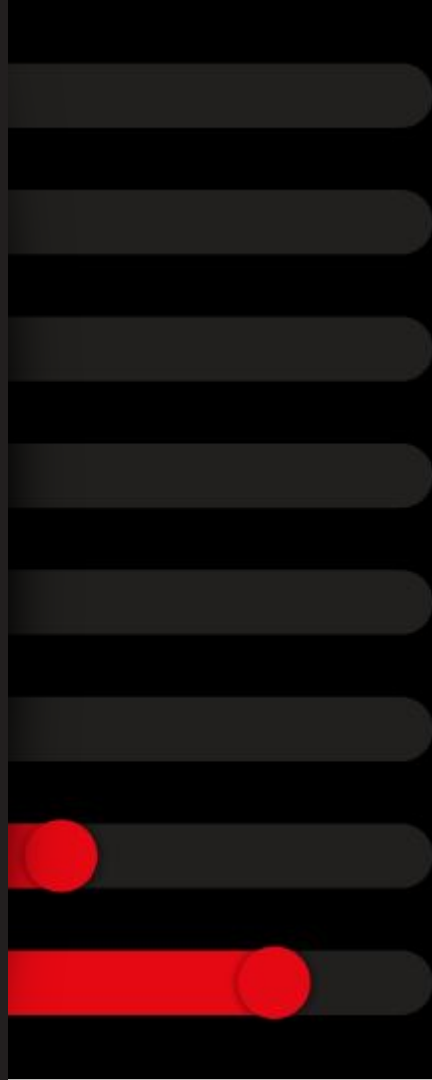


Netflix and FreeBSD: Using Open Source to Deliver Streaming Video

Open Connect



Open Connect is Netflix's CDN.
It is **global, efficient,** and
purpose-built for distributing
Netflix's content.

The Open Connect Appliance

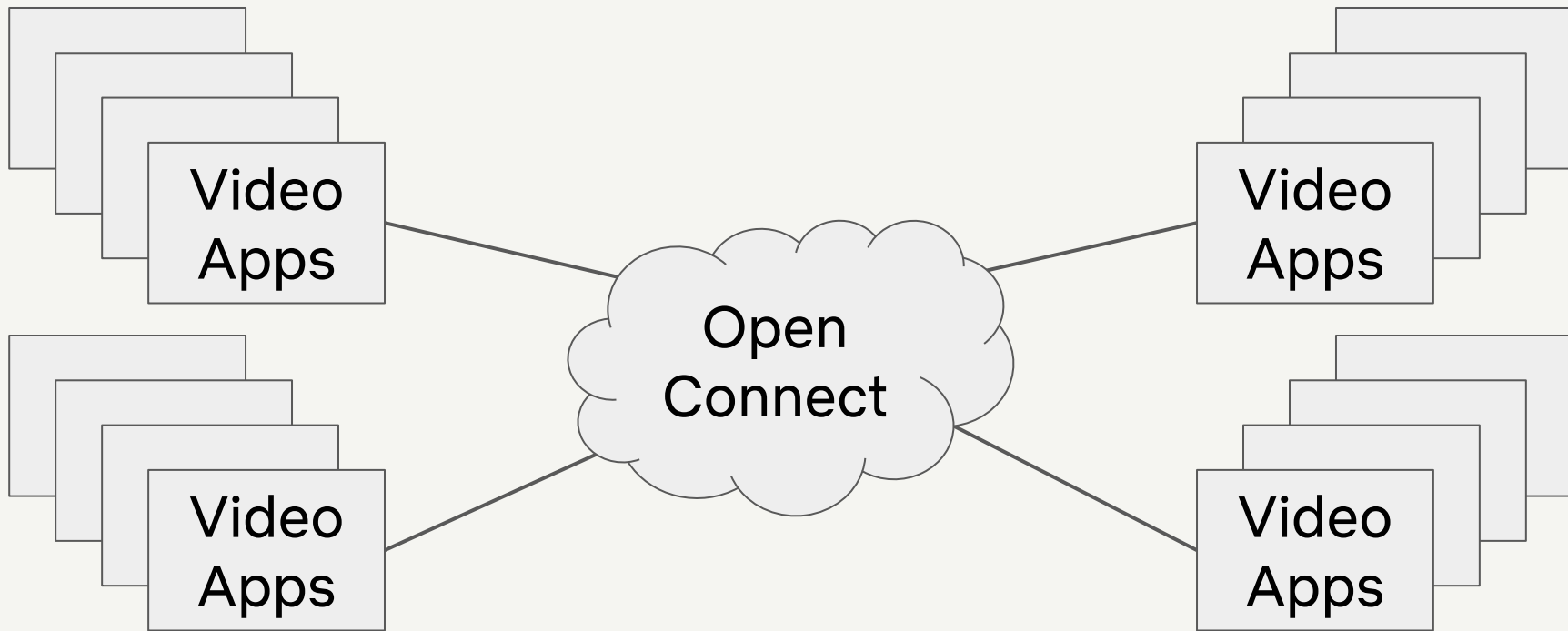
The OCA is the “backbone” of the Open Connect network.

The OCA almost exclusively runs open-source software.

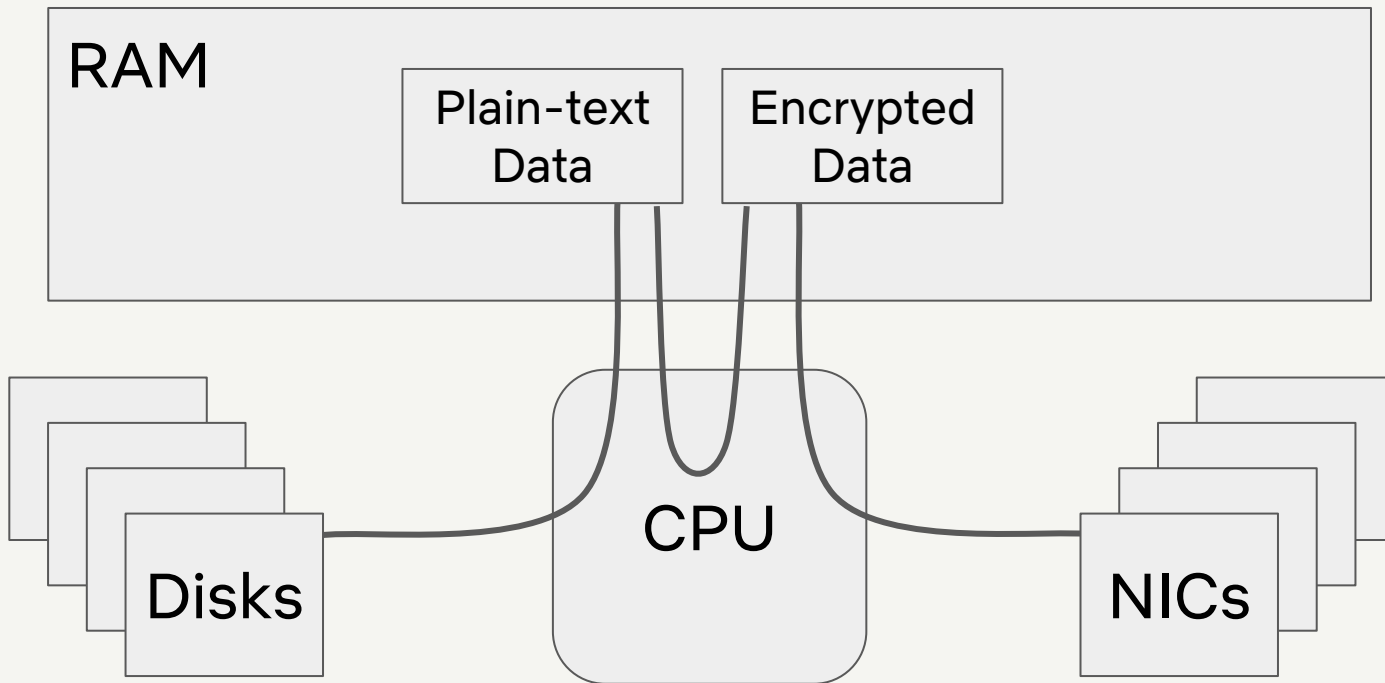


40Gb/s Storage Appliance with 248TB storage
(2RU form factor)

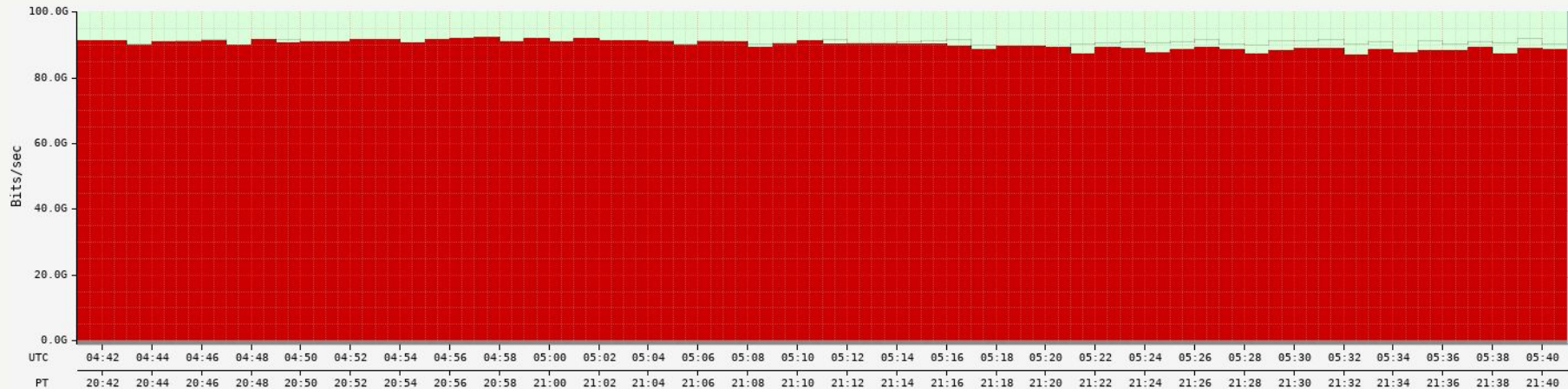
Open Connect Traffic



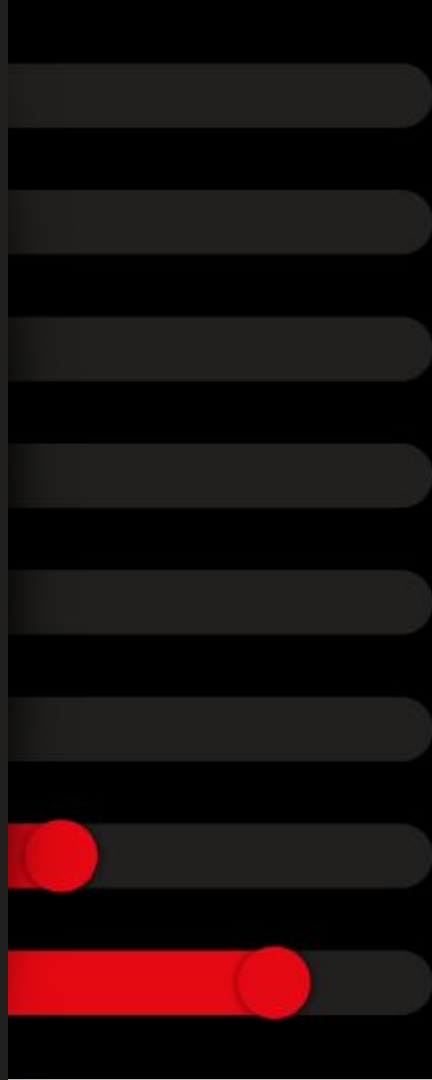
Netflix OCA Workload



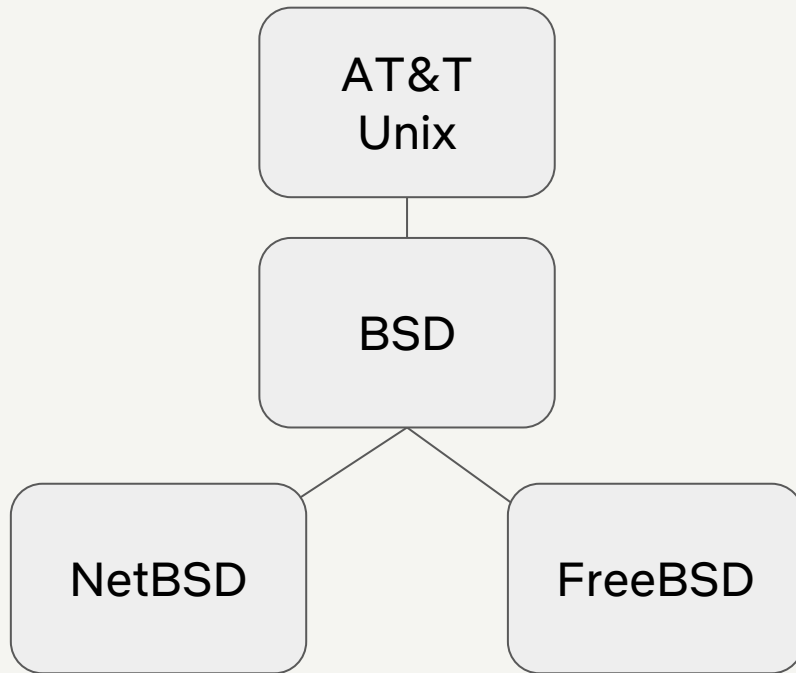
**Using FreeBSD and commodity parts,
we achieve **90 Gb/s** serving
TLS-encrypted connections with
~55% CPU on a 16-core 2.6-GHz
CPU.**



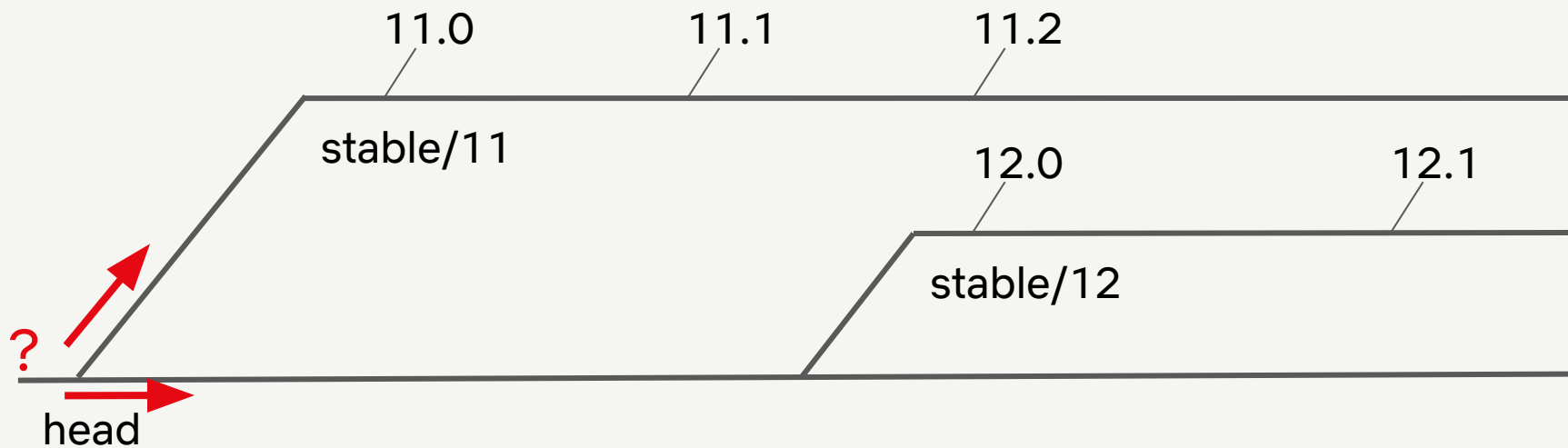
OCA Operating System



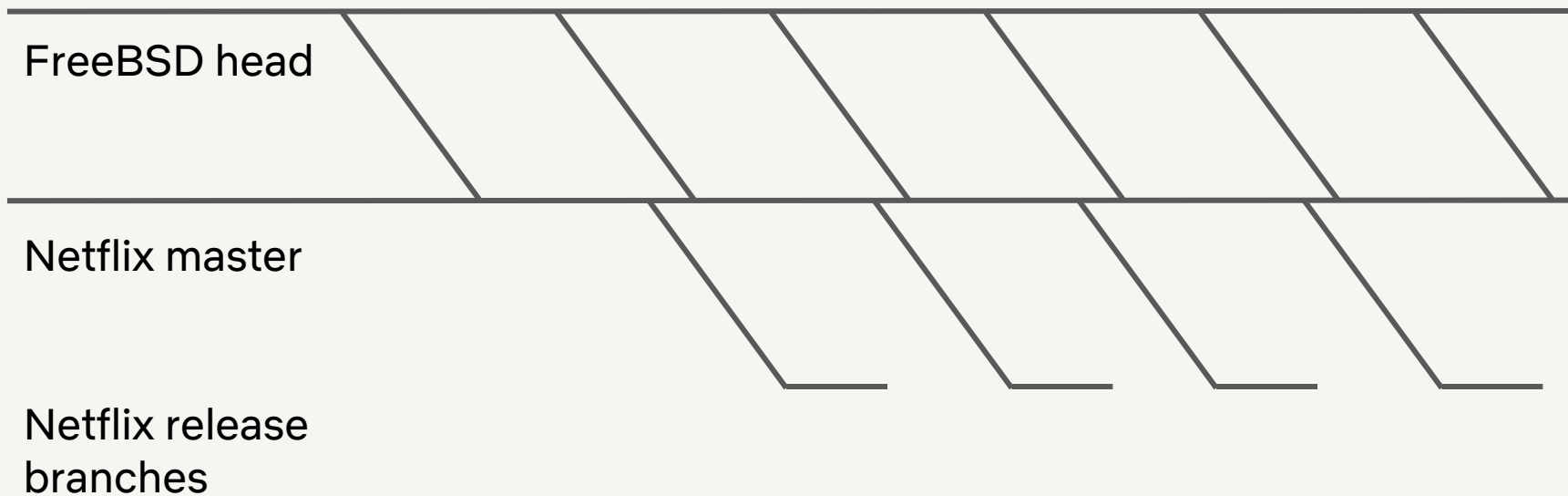
(Abridged) BSD “Family Tree”



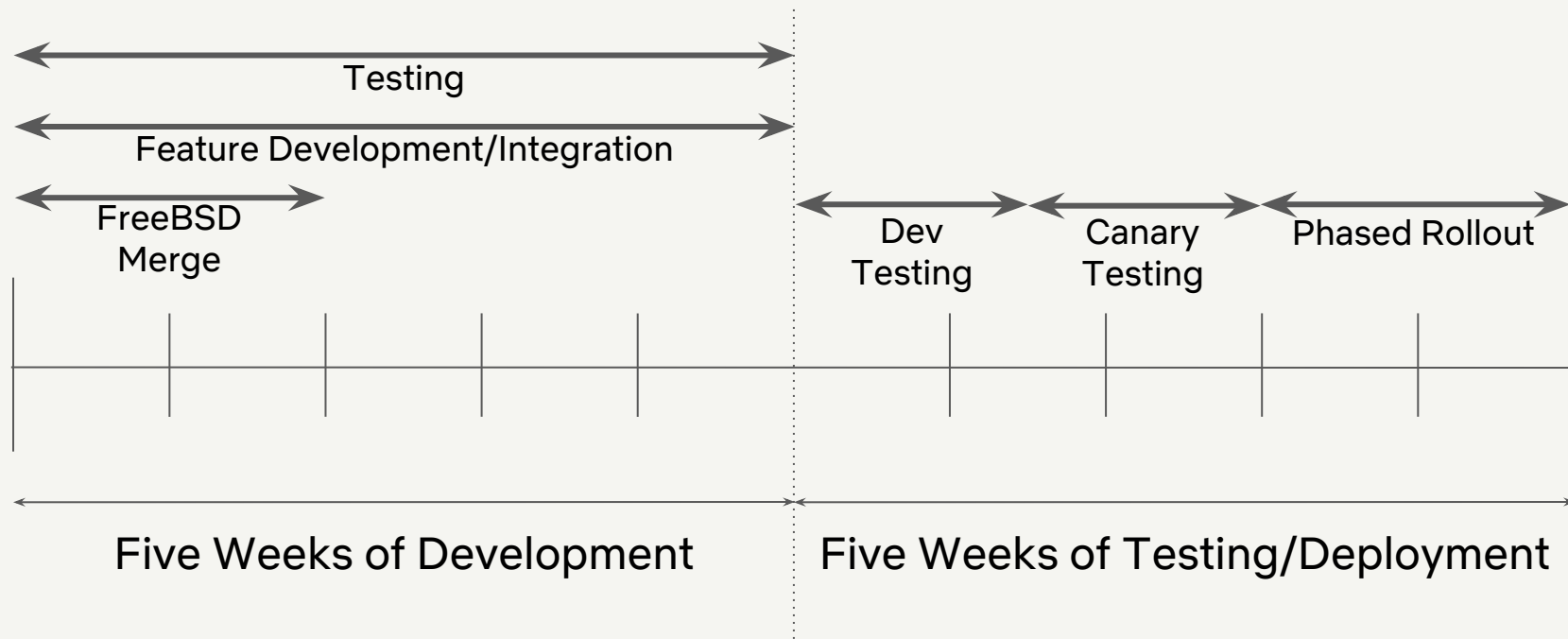
FreeBSD Release Cycle



We Track FreeBSD “Head”



Typical Release Cycle



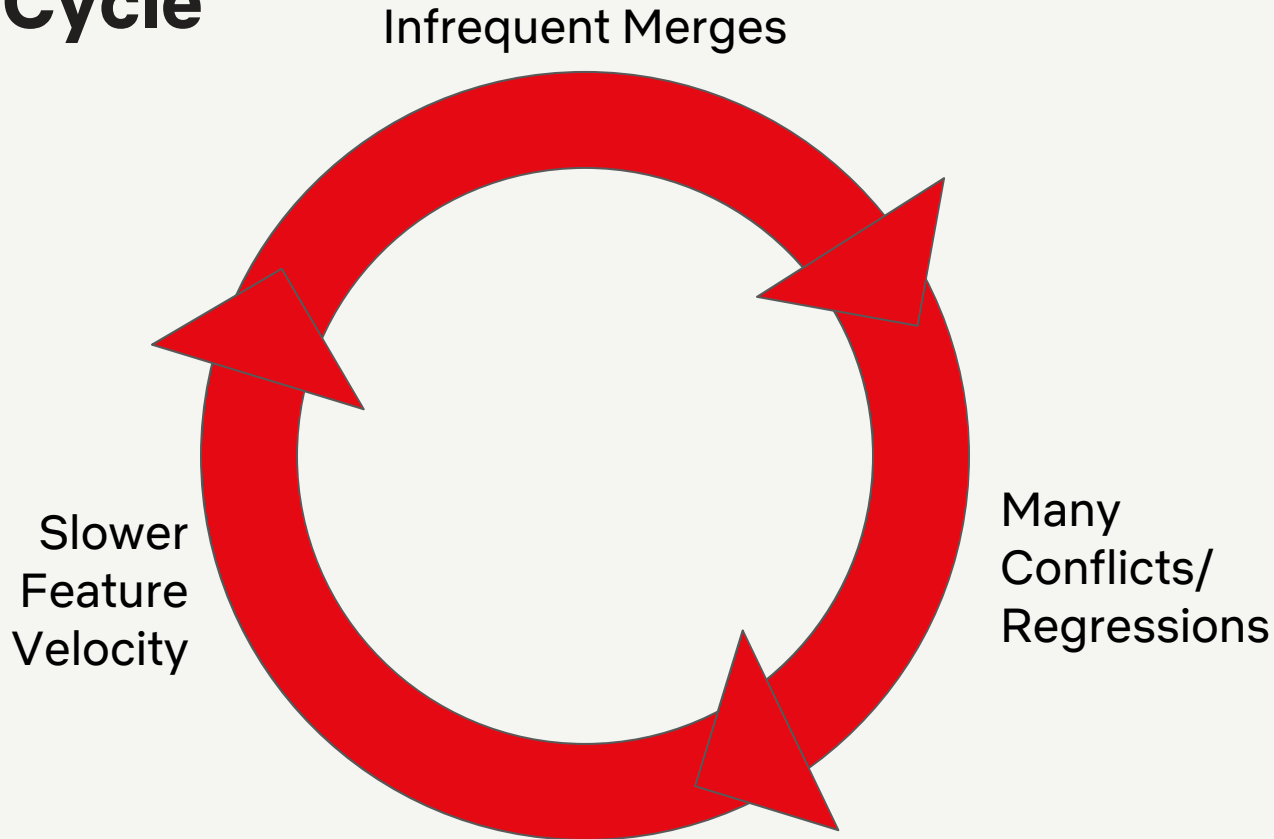
Examples of Features

- NUMA enhancements
- Asynchronous sendfile
- Kernel TLS
- Pbuf allocation enhancements
- “Unmapped” mbufs
- I/O scheduling
- TCP algorithms
- TCP logging infrastructure

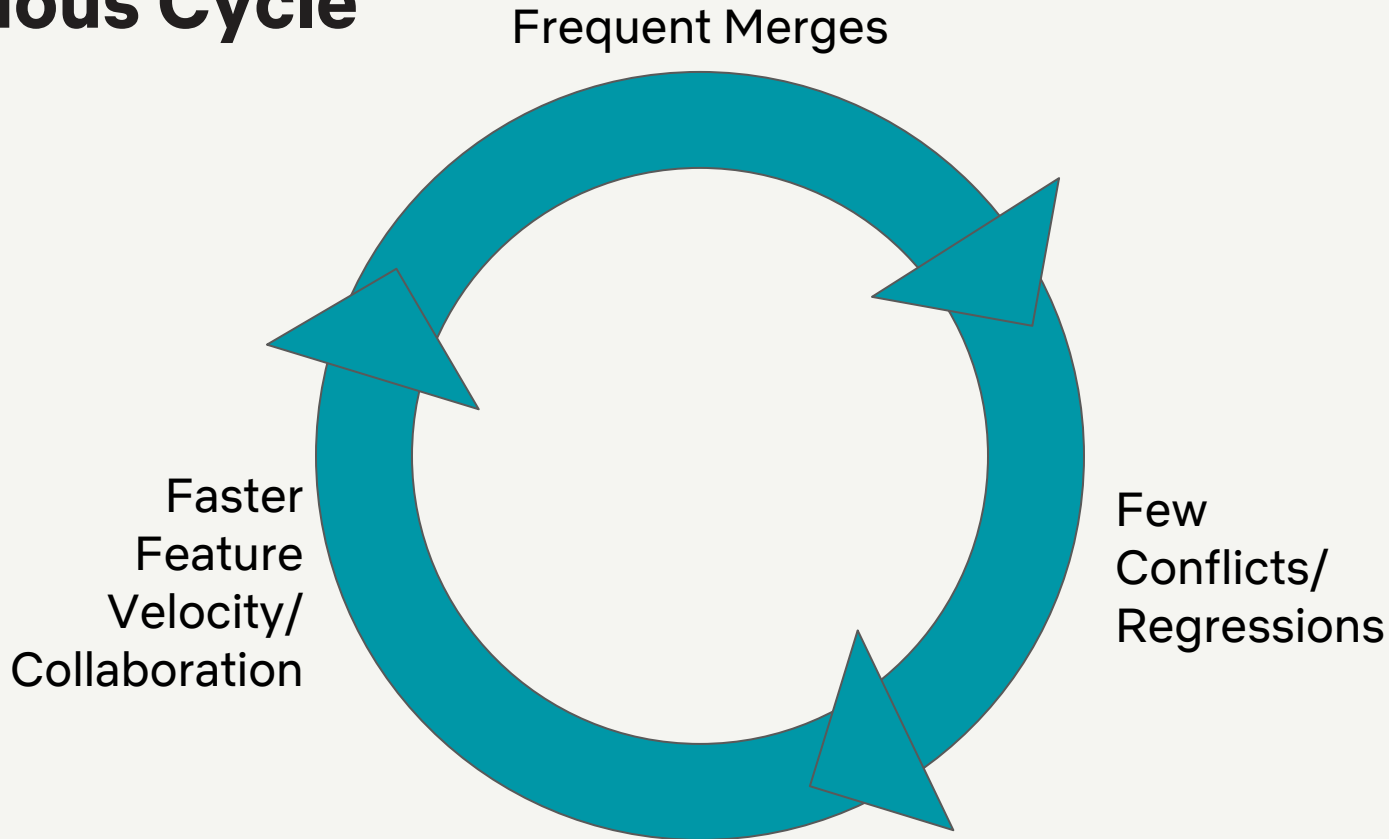
Tracking “head” lets us stay
forward looking and
focused on **innovation**.

Downstream users of open-source projects can be stuck in “vicious” or “virtuous” cycles.

Vicious Cycle



Virtuous Cycle



Reasons We Keep Local Diffs

- Information covered under NDA
- Feature which is still in development/testing
- Feature which needs to be generalized

It is our intention to upstream any code which we can.

Benefits to Netflix of Tracking FreeBSD “Head”

- Quicker feature iteration
- Quicker access to new FreeBSD features
- Quicker bug fixes
- Enables collaboration
- Minimizes merge conflicts
- Amortizes merge “cost”

Benefits to FreeBSD

- Wide deployment of “head” branch code (albeit in a narrow use case)
- Early intensive testing
- Incentive for Netflix to upstream code

Objections to Running “Development” Code

- It isn't stable
- Why should you pay to find the bugs others will find while testing head?
- Aren't there more security bugs?
- No one runs development branches
- Pay monthly “cost” to do merges
- You get new bugs each month

Running FreeBSD “head” lets us deliver large amounts of data to our users very efficiently, while maintaining a high velocity of feature development.

Thank you

NETFLIX