System Architecture & Design of

NETFLIX

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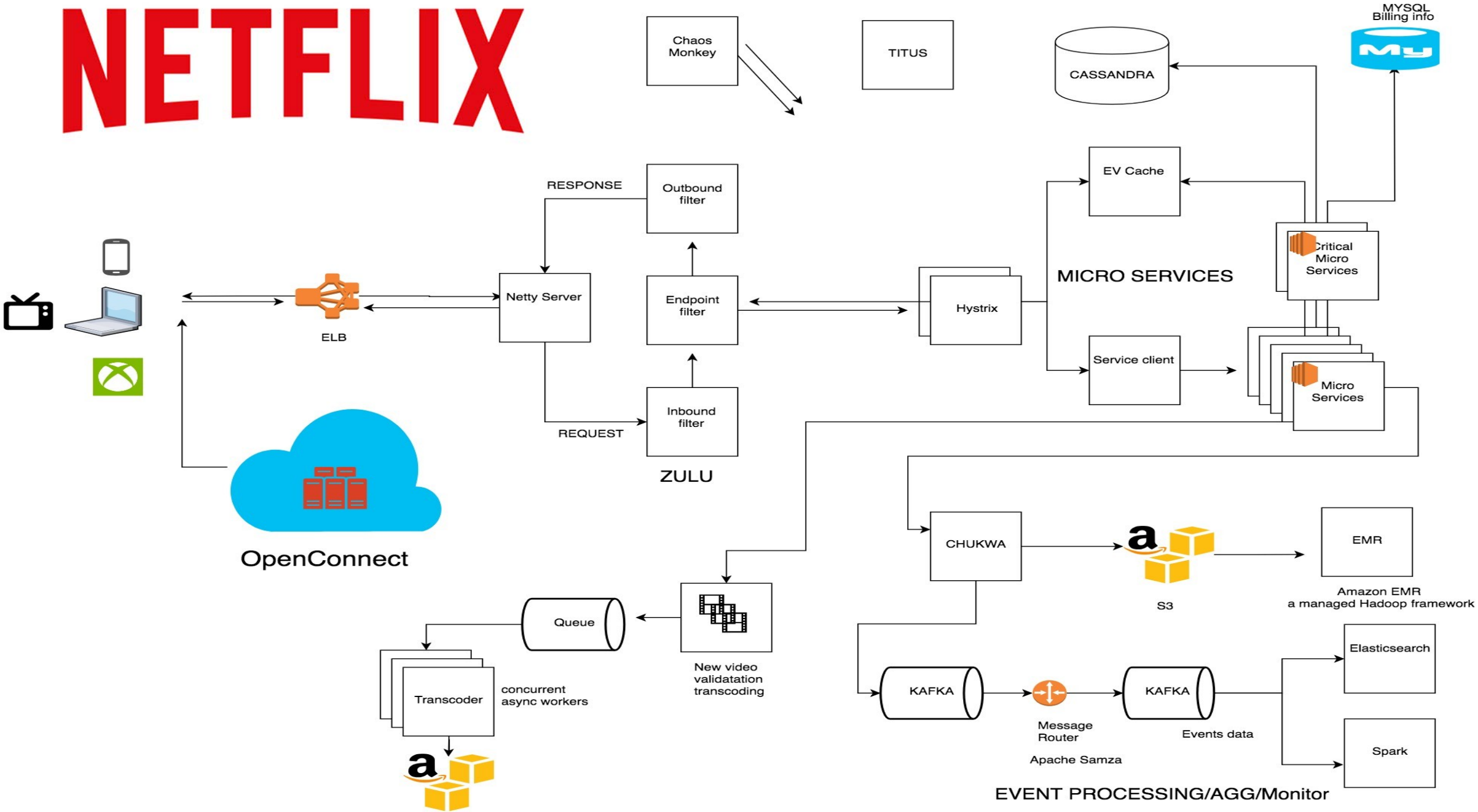
Fun Facts:

- Founded in 1997 – used to send DVD’s via Mail
- Started streaming only in 2007
- First production – 2013: “House Of Cards”
- Serves 117.58 million in 190 Countries
- Streams 190 million hours of content everyday – 15 TB/sec
- 97 Billion hours of content streamed already
- First app was written fully in Java and Js, took 40 minutes to startup

Netflix Stack

- Node.js – Edge Services
- Restify – Https request handling server side
- React js – Web Apps client side
- Falcor – Databases: MySQL, Cassandra
- Rxjs – AJAX, user interaction

AJAX - Asynchronous JavaScript and XML

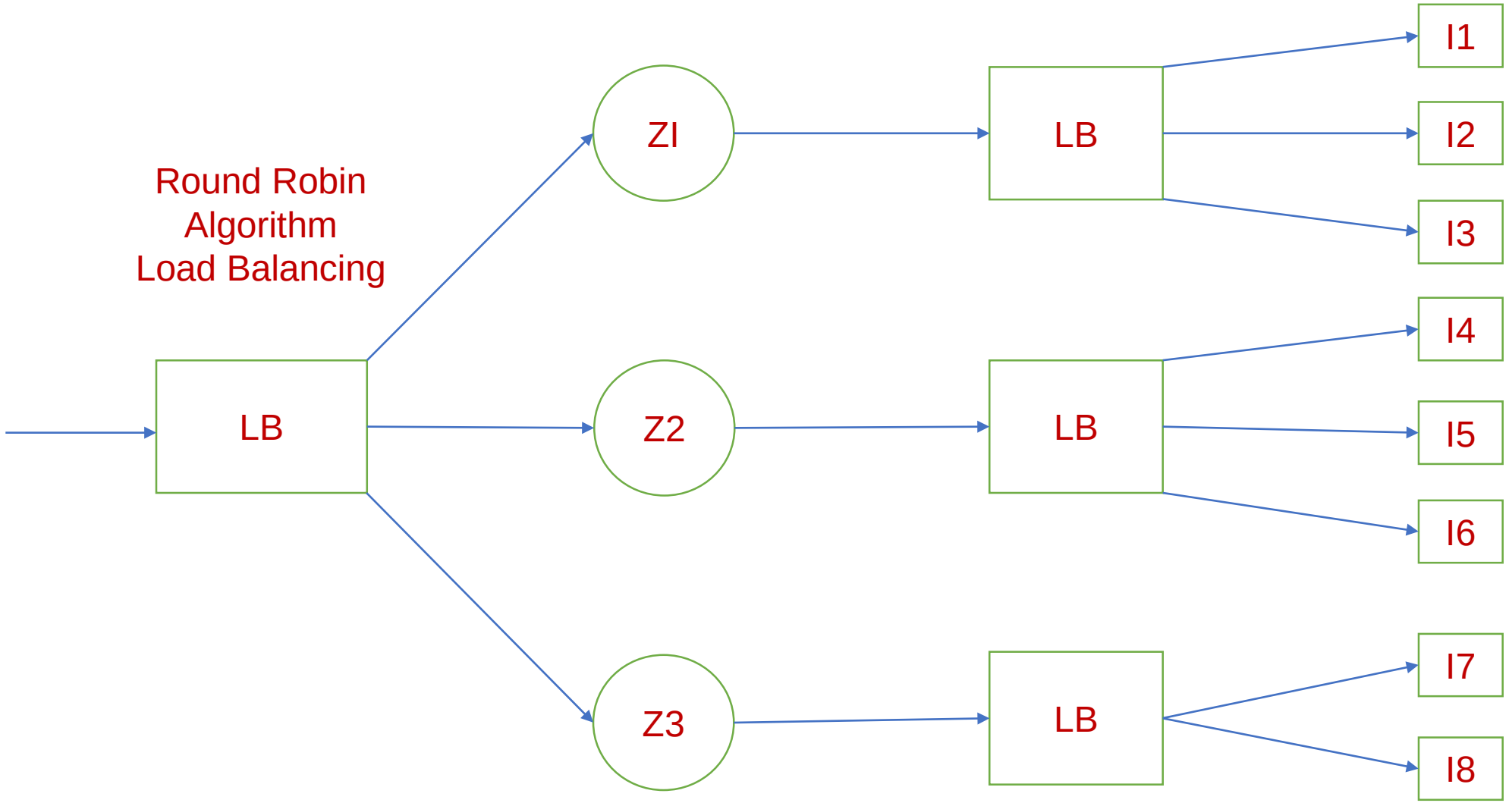

NETFLIX
Chaos Monkey
TITUS
CASSANDRA
MYSQL
Billing info
RESPONSE
Outbound filter
EV Cache
Critical Micro Services
MICRO SERVICES
ELB
Netty Server
Endpoint filter
Hystrix
Service client
Micro Services
REQUEST
Inbound filter
ZULU
OpenConnect
CHUKWA
S3
EMR
Amazon EMR
a managed Hadoop framework
Queue
New video validatation transcoding
Transcoder
concurrent async workers
KAFKA
Message Router
Apache Samza
KAFKA
Events data
Elasticsearch
Spark
EVENT PROCESSING/AGG/Monitor

Cloud options & Overview

- Operates in Two Cloud Services:
  - Amazon Web Services
  - Open Connect – CDN
- Three major components:
  - Open Connect – CDN
  - Backend – AWS
  - Client -You

Content Delivery Network

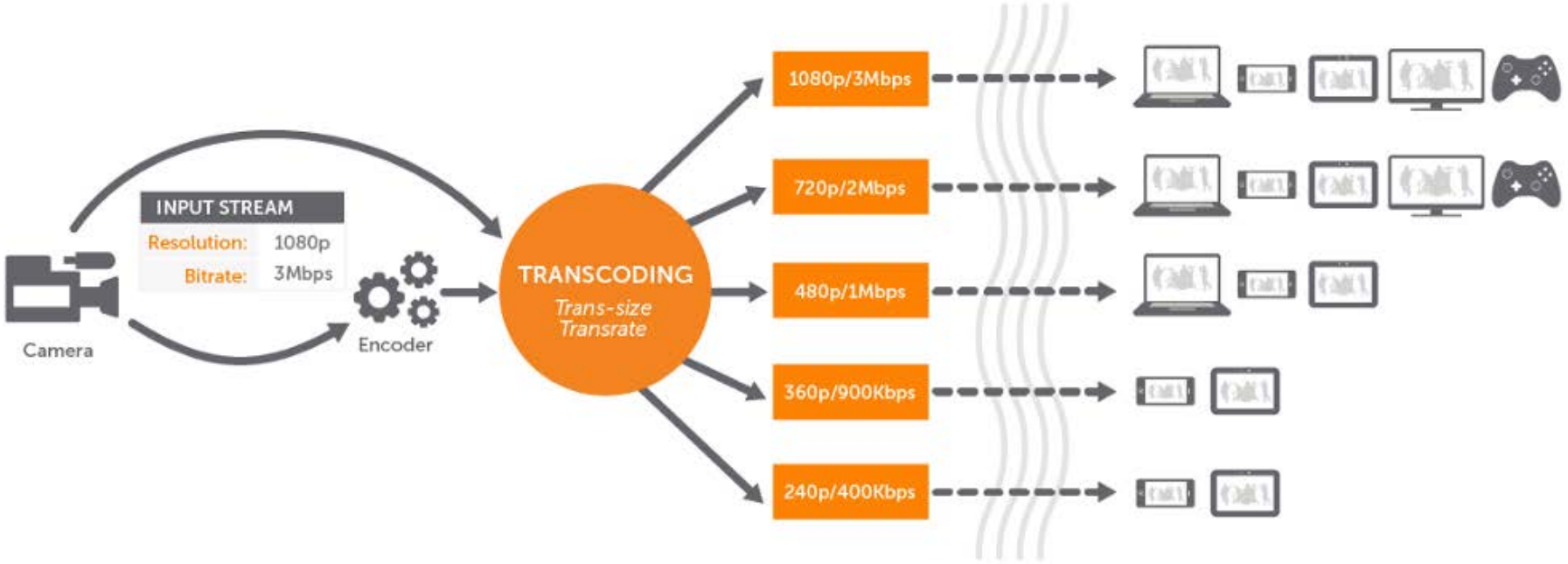
Elastic Load Balancer



Video Transcoding & Encoding

INPUT PROTOCOLS	INPUT CODECS		OUTPUT CODECS		OUTPUT PROTOCOLS
Adobe RTMP, RTSP/RTP, MPEG-TS, ICY (SHOUTcast/Icecast)	Video:	H.265/HEVC, H.264/AVC, VP9, VP8 MPEG4 Part 2, MPEG2	Video:	H.265/HEVC H.264/AVC, H.263 (v2), VP9	Apple HLS, Adobe HDS, MPEG-DASH, Microsoft Smooth Streaming, Adobe RTMP, RTSP/RTP, MPEG-TS
	Audio:	MP3, AAC, AAC-LC, HE-AAC+ v1 & v2, MPEG1 Part 1/2, Speex, G.711, Opus, Vorbis	Audio:	AAC, AAC-LC, HE-AAC+ v1 & v2, Opus, G.711	

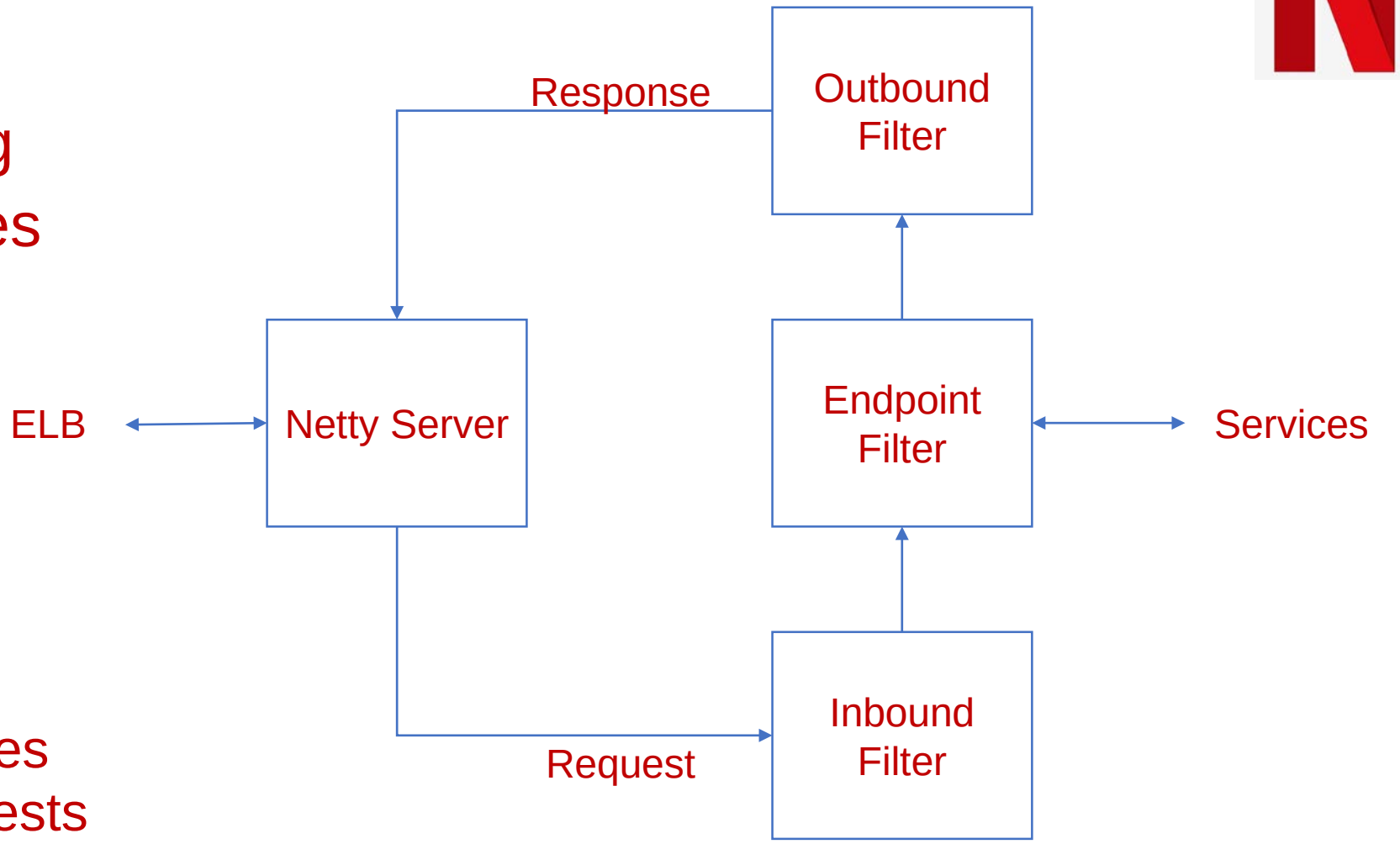
1,200 versions of each video for adaptive bit rate streaming.



ZUUL

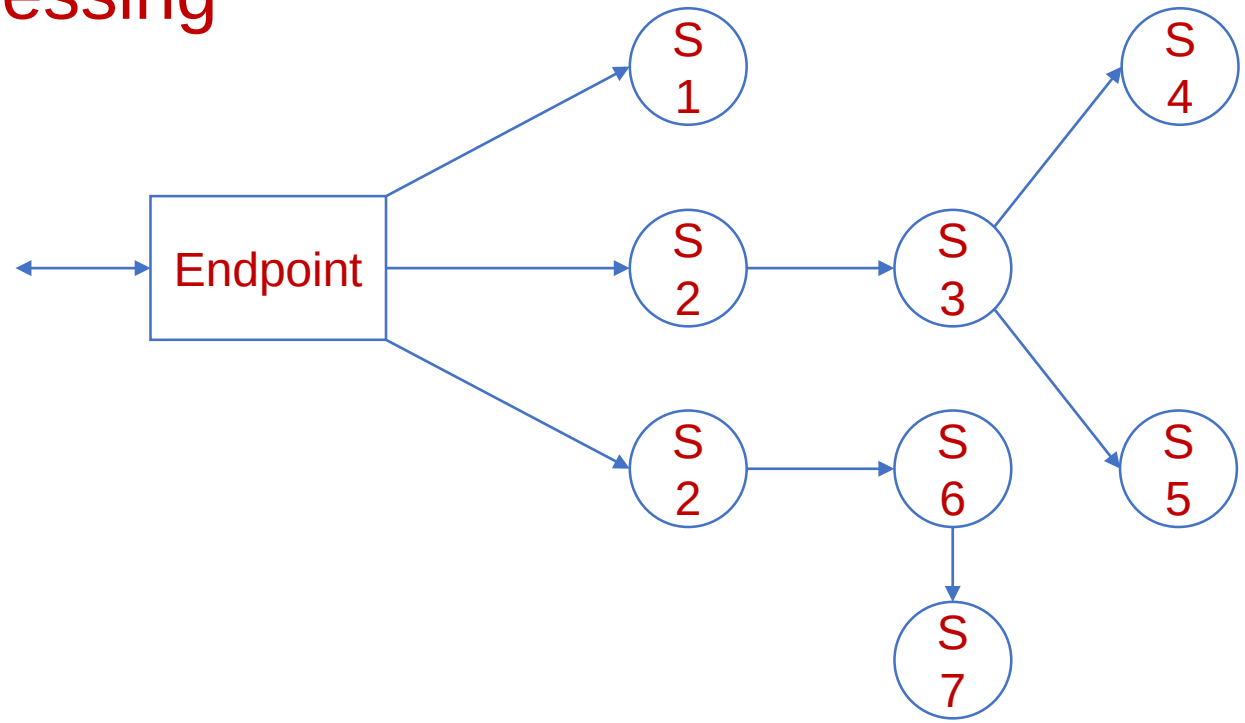
- Dynamic Routing
- Gateway Services
- Monitoring
- Security

- Application:
  - Shared Traffic
  - Load Test
  - Test new Services
  - Filter Bad Requests



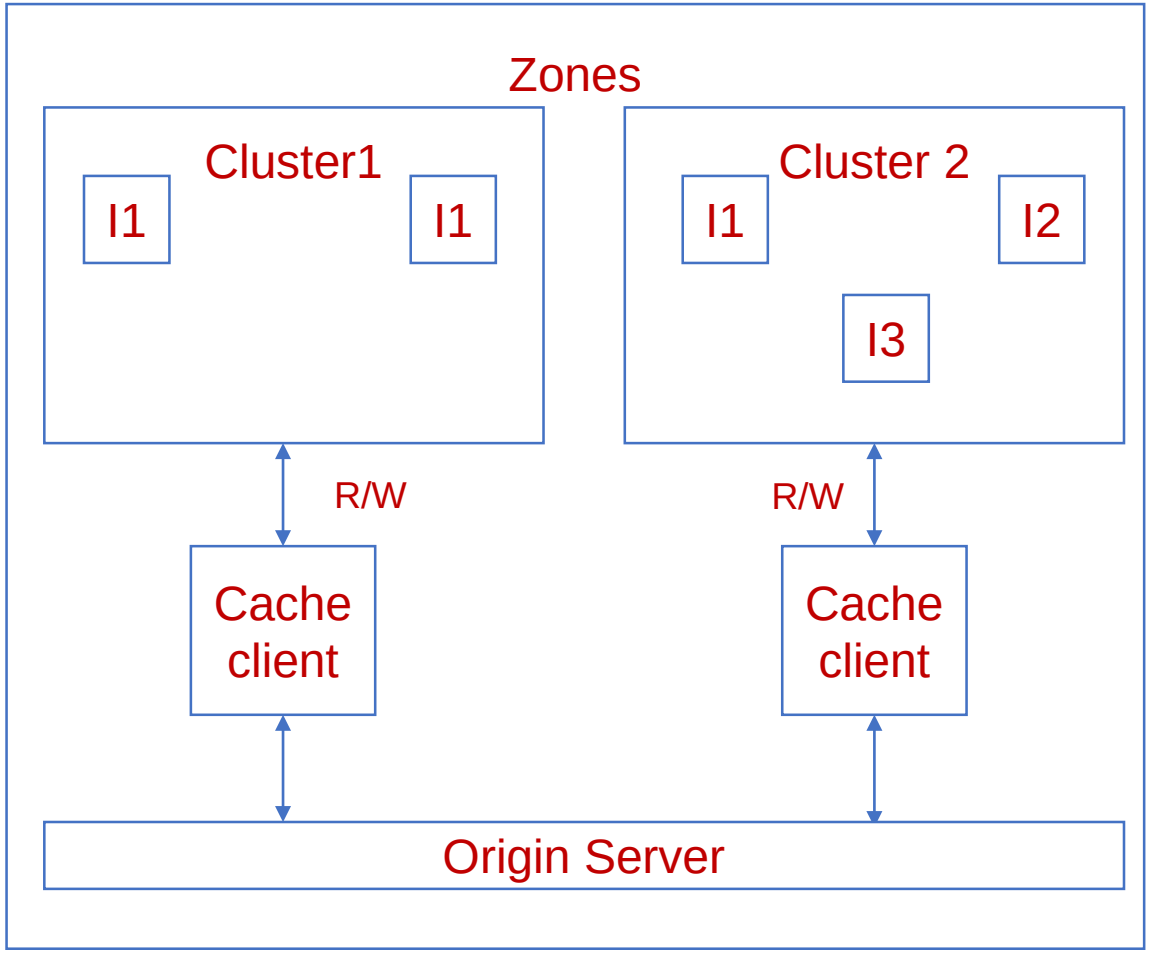
Hystrix

- Processing critical API’s
- Stateless transaction processing
- Applications:
  - Timing calls > time
  - Reject Req when busy
  - Disconnection
  - Fall Back response
  - Metrics – data mining



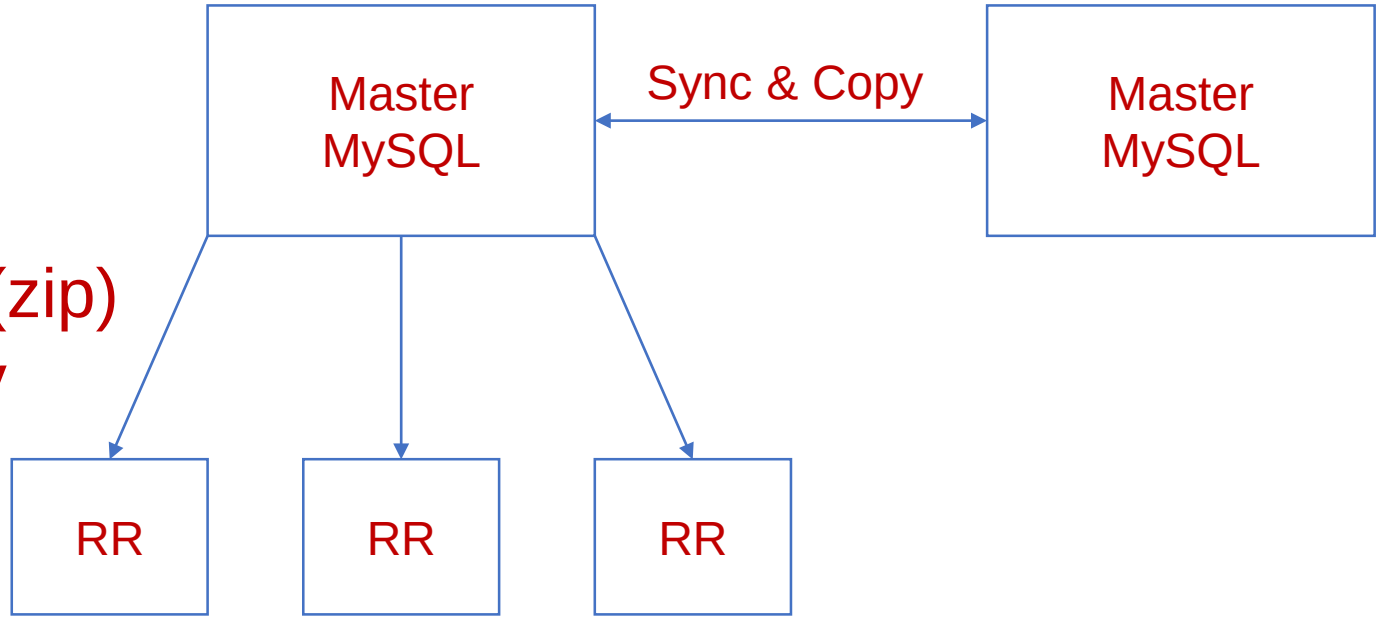
EV Cache

- Based on Mem-Cache
- Runs on SSD’s
- Open Connect Appliance
- Each cache service has 300TB of space
- Advantages:
  - Throughput
  - Latency
  - Reduced cost, by using SSD instead of RAM



Database Management

- MySQL – RDBMS
- Cassandra – NoSQL
- On AWS
- Cached on Big CDN’s
- W:R::9:1
- Scheduled jobs for backup (zip)
- Captures 90TB of data daily
- Advantages:
  - Highly available
  - Scalable
  - Lage data



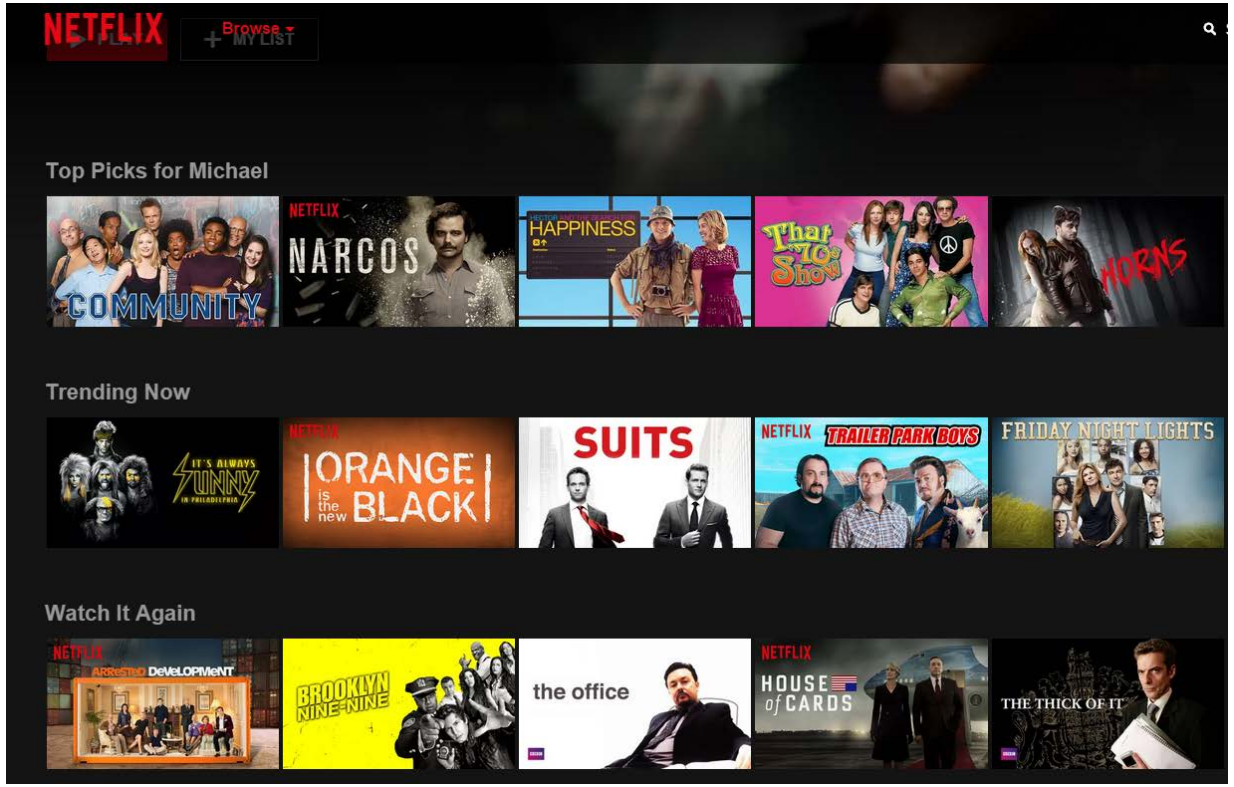
Ingesting data & Processing

- Apache Kafka
  - Real time processing
  - Streaming services
  - High-throughput
  - Low-latency
- Apace Chukwa
  - Distributed Computing
  - Hadoop Distributed File System (HDFS)
  - MapReduce
  - Highly Scalable

- 700 billion events
- 13TB everyday
- Usage:
  - Video viewing activity
  - UI Activity
  - Error Logs
  - Performance Events
  - Troubleshooting

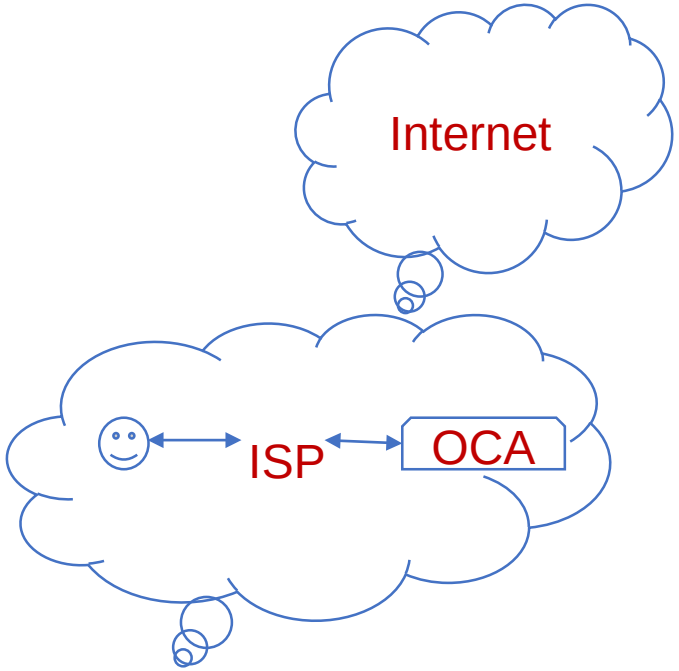
Artificial Intelligence

- SPARK – AWS
- Artwork Personalization
- Recommendations
  - Collaborative Filtering
  - Content based filtering
- Applications:
  - Sorting
  - Classification
  - Row selection
  - Relevance rank

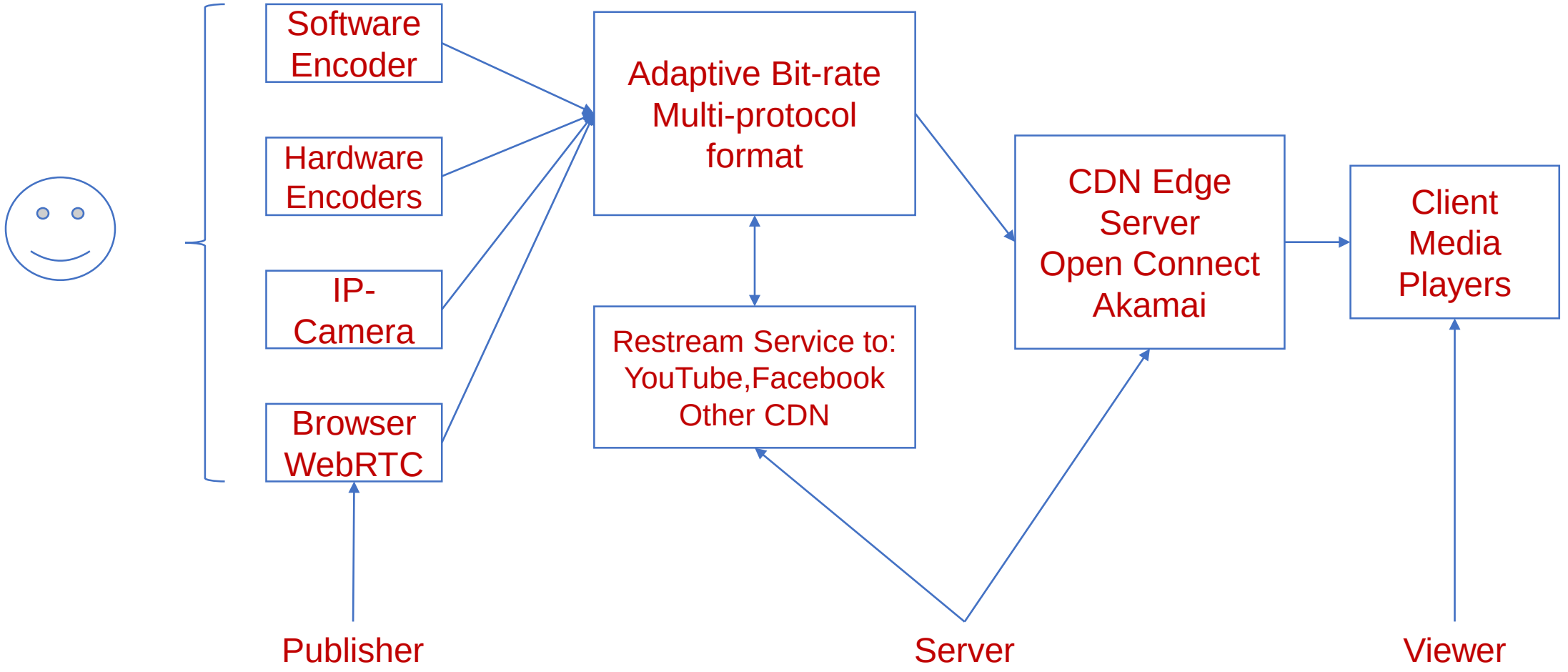


Open Connect

- Free of charge to ISP’s
- Highly Available: redundant systems for everything
- Local ISP server boxes
- Small OCA
- Big OCA
- Multiple Level Indexing
- Even small OCA is able to processes 13,000 HD file request simultaneously



Live Streaming



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See What’s Next