Making New Friends

Apache Traffic Control + Varnish

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Content Distribution Architect

Disney Streaming Services - Who We Are

- Disney Streaming Services brings beloved characters, timeless stories, and epic sporting events to a global audience through world-class direct-to-consumer video services including Disney+ and ESPN+.

- Built Media Caching Solutions around Live Events
  - Wrestlemania 34, Super Bowl LI
- Leveraging Commercial Content Delivery Networks (CDN)
- VOD was a different experience
  - WWE Network VOD and HBO Now
  - Lower peaks but more sustained traffic
  - Diverse content library
  - Variety and library size impacted user experiences

Who I Am

- Previously at Cisco/Synamedia contributing to Traffic Control
  - Focus on turnkey Service Provider CDN product

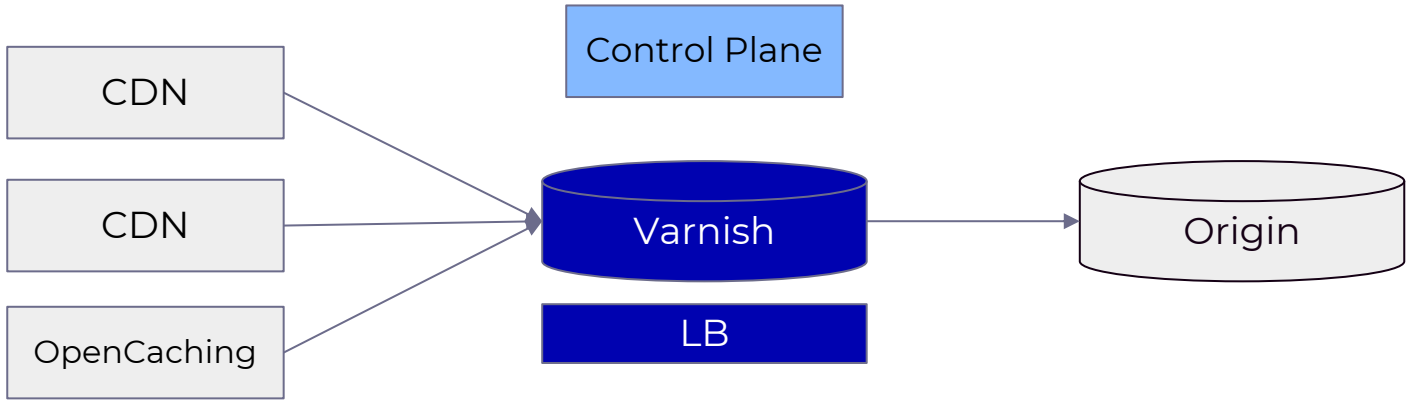
- Currently with Disney Streaming Services

- Combining existing Varnish caching infrastructure with Apache Traffic Control

Topics

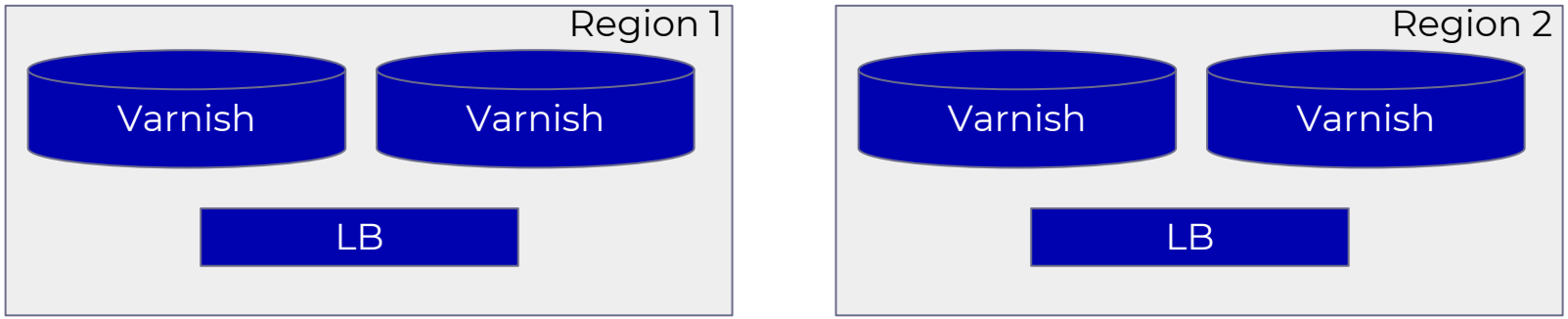
- Content Distribution at Disney Streaming Services
- Varnish Cache Basics
- Integrating Varnish in ATC
- Q&A

Content Distribution at Disney Streaming



- Focused on origin shielding for commercial CDNs and OpenCaching
- Mix of Varnish caches and L7 load balancers
- Custom control plane

Origin Shield Request Routing



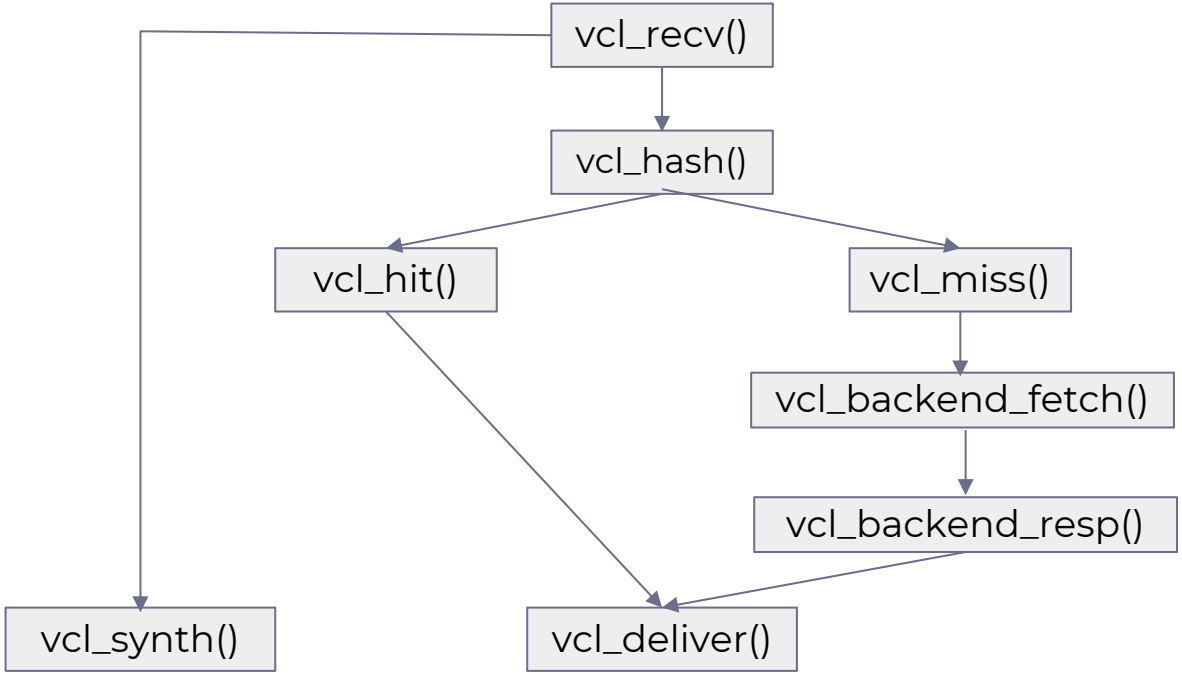
- Multiple Clusters of caches serve geographic regions
- Clients are CDNs so they perform localization on viewers
- Loadbalancers do consistent hashing and health checking on caches

Varnish Cache

Varnish Cache

- Varnish is a highly configurable reverse proxy
- Also Open Source! BSD-2 clause
- Configurable through Varnish Config Language (VCL)
  - Handles remapping, rewrites, TTLs, headers, custom logging, etc...
  - Pluggable backend selection
  - Backend health probing
- Separate TLS terminating proxy - Hitch or HAProxy

VCL Subroutines



CDN Request Processing Responsibilities

- Delivery Service Isolation
- Request Scrubbing/Normalization
- Backend Selection
- Cache Key Creation
- Cached Object TTL Management
- Setting Response headers
- Logging

VCL Delivery Service Isolation

- VCL Labels provide isolation between Delivery Services
- Labels are separate bundles of VCL specifying different behaviors
- Label is activated based on incoming request properties (i.e. Host header)

```
sub vcl_recv() {
  if (req.http.Host ~ "live.cdn.example.com") {
    return (vcl(live_ds));
  } else if (req.http.Host ~ "vod.cdn.example.com") {
    return (vcl(vod_ds));
  } else {
    return (synth(503));
  }
}
```

Request Normalization

```
sub vcl_recv() {
  unset req.http.Authorization;

  if (req.method != GET) {
    return(synth(405));
  }


  set req.url = regsub(req.url, "\?.*$", "");
  set req.url = regsub(req.url, "^", "/req_prefix");
}
```

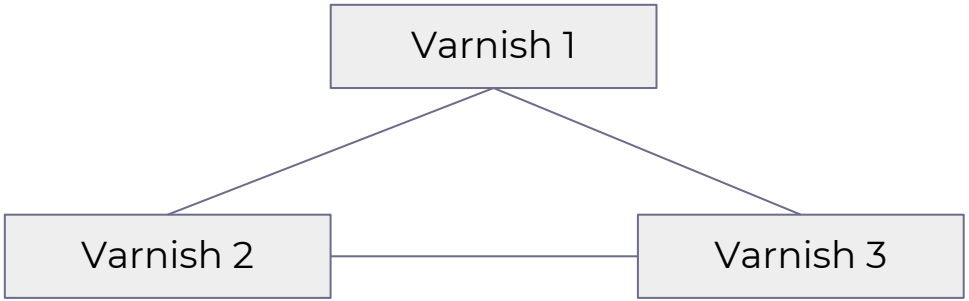
- Stripping Request Headers
- Filter Request Method
- Strip query strings
- URL Rewrite

Backend Selection

```
import directors;

backend parent1 {
  .host = “192.168.0.1”;
}

backend parent2 {
  .host = “192.168.0.10”;
}

sub vcl_init() {
  new random_dir = directors.random();
  random_dir.add_backend(parent1, 1.0);
  random_dir.add_backend(parent2, 9.0);
}

sub vcl_recv() {
  set req.backend_hint = random_dir.backend();
}

sub vcl_backend_req() {
  set bereq.http.Host = “origin.example.com”;
}
```

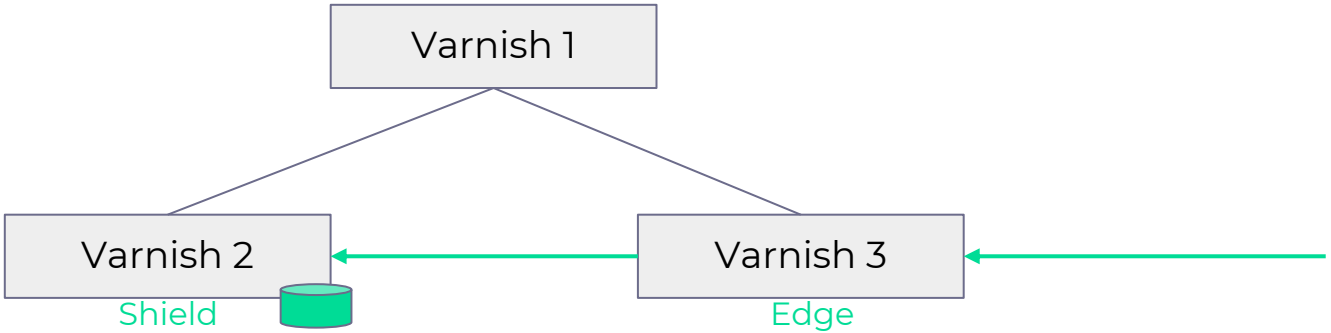
- Choosing Backend/Next-Hop
  - Random Weighted Selection of backend
  - Other Directors - Hash, Shard, Fallback, etc...
  - Host header remap

Varnish Consistent Hashing



- Requests are received by any cache in the cluster, i.e “Edge” host
  - Shield fetches from Origin and caches locally
  - Edge proxies response back to client
- Shield host is determined by consistent hash of path
- Edge host is determined by client connection

Varnish Consistent Hashing



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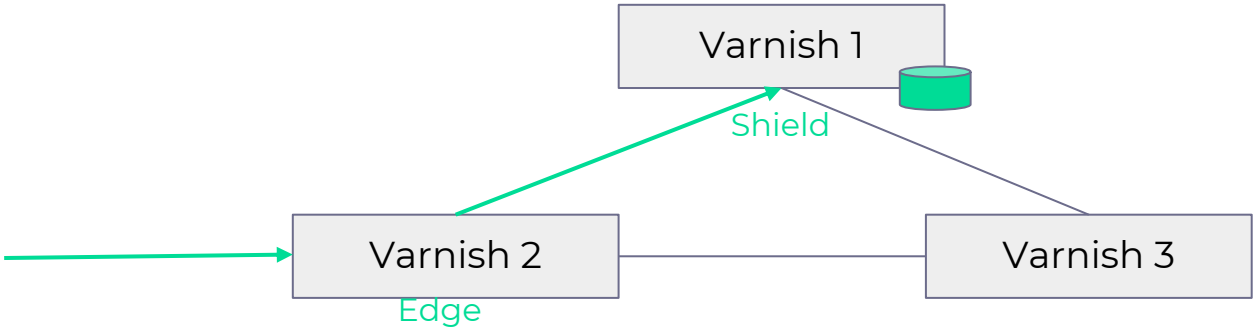

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Integrating Varnish in ATC

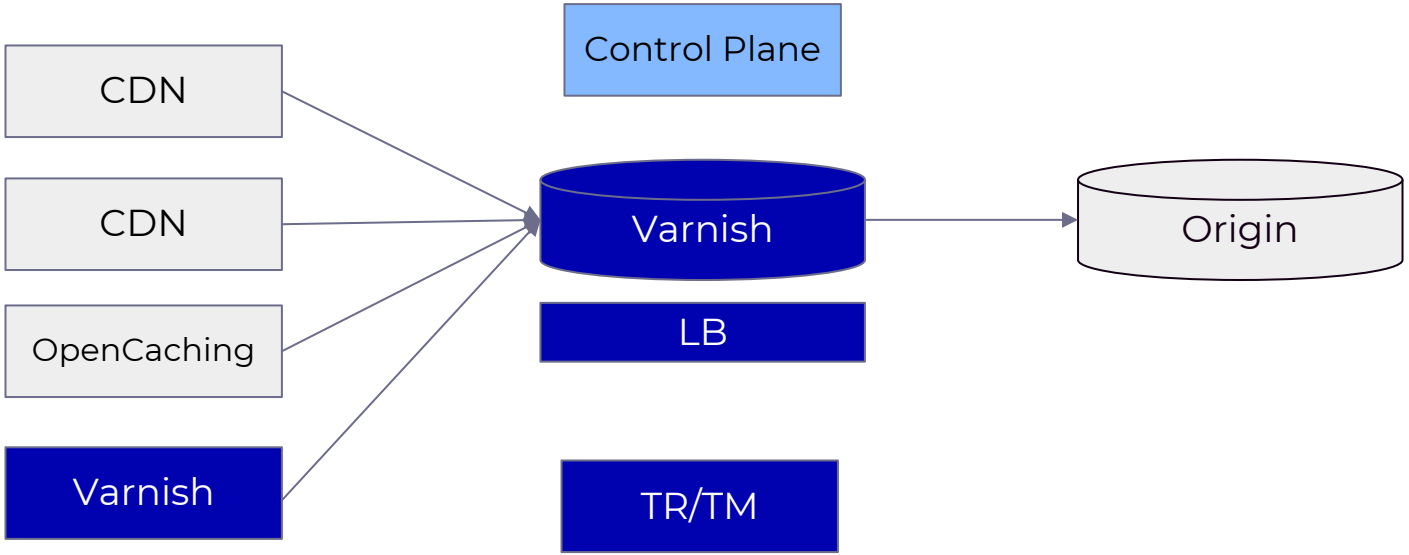
Integrating Varnish in ATC

- Motivation
- Configuration Generation
- Health Monitoring of Varnish

Integrating Varnish in ATC

- Prototyping custom solution as component of edge delivery strategy
- Extension of existing origin shield infrastructure
- Uses ATC Traffic Monitor for Health Protocol
- Uses ATC Traffic Router for client localization and redirection

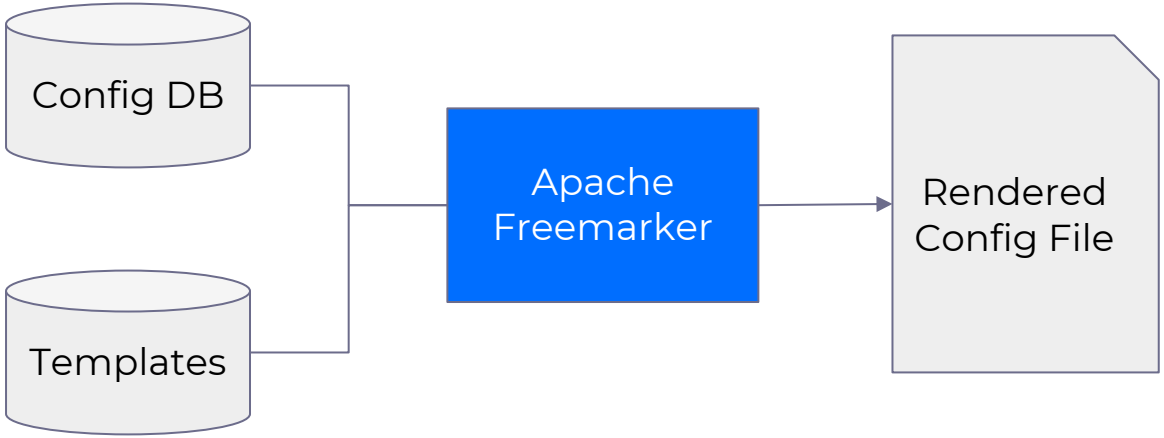
Prototype Edge Delivery



Configuration Generation

- Implementing ATC TO authentication and APIs
- Hosting static files
  - (Deep)CZF
  - MMDB
- Added generation of
  - crconfig.json
  - monitoring.json
  - sslkeys.json
- Control Plane uses Apache Freemarker templates to generate VCL & ATC files

Config File Templates



- Freemarker combines context variables from DB with templates.
- Separating syntax of file from config variables eases development.

CRConfig Template Sample

```
"deliveryServices": {
       <#list deliveryServices as ds>
      "${ds.id}": {
          "anonymousBlockingEnabled": "${ds.atcVpnBlock}",
          <#if ds.atcBypassFqdn?has_content>
            "bypassDestination": {
              "HTTP": {
                "port": "80",
                "fqdn": "${ds.atcBypassFqdn}"
              }
            },
          </#if>
          "domains": [
              "${ds.dnsName}.${cdn.domainName}"
          ],
},
```

Health Monitoring of Varnish

- Implemented a Varnish Module (vmod) to replace astats
- Varnish needs a vmod to generate an HTTP response body
- Code references astats implementation when possible
  - Uses same /proc and sysfs interfaces for data gathering
- No DS stats yet, just load avg and NIC bandwidth
  - Need further instrumentation for Delivery Service specific stats
  - Likely based on another vmod for creating custom counters

Calling libvmod_astats

```
import astats;

acl atc_tm_acl { “192.168.10.0”/24;}

sub vcl_recv() {
  if (req.url ~ “^/_astats”) {
    if (client.ip ~ atc_tm_acl) {
      set req.http.astats = true
      return(synth(200, "OK"));
    } else {
      return synth(403);
    }
  }
}

sub vcl_synth() {
  if (req.http.astats) {
    synthetic(astats.info(...));
    return (deliver);
  }
}
```

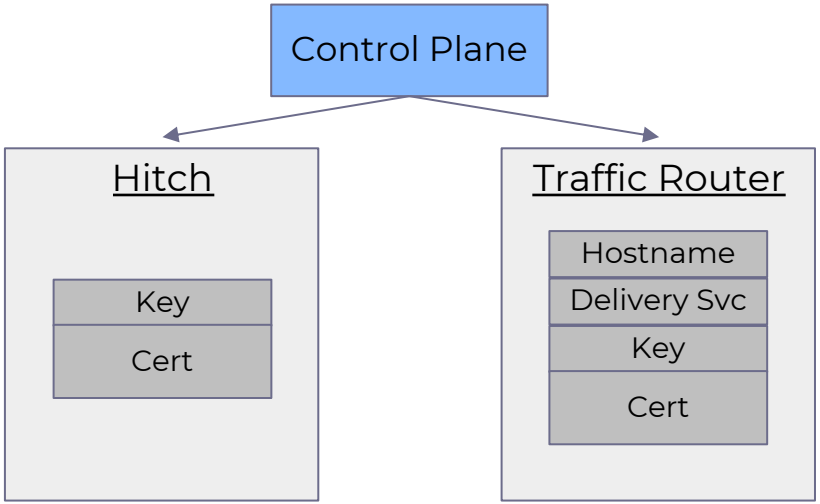
- vcl_recv()
  - Matches URL with regex
  - Apply Traffic Monitor ACL
  - Signals astats mode to synthetic response with internal request header
- vcl_synth()
  - Calls astats with interface name
  - Astats internally generates JSON response
  - Body returned to client

Health Monitoring of Varnish

Server	Type	IPv4	IPv6	Status	Load Average	Bandwidth (mbps)
varnish04-c01-ewr1	EDGE	true	false	REPORTED - available	0.1	0.11 / 25,000
varnish03-c01-ewr1	EDGE	true	false	REPORTED - available	1	0.11 / 25,000

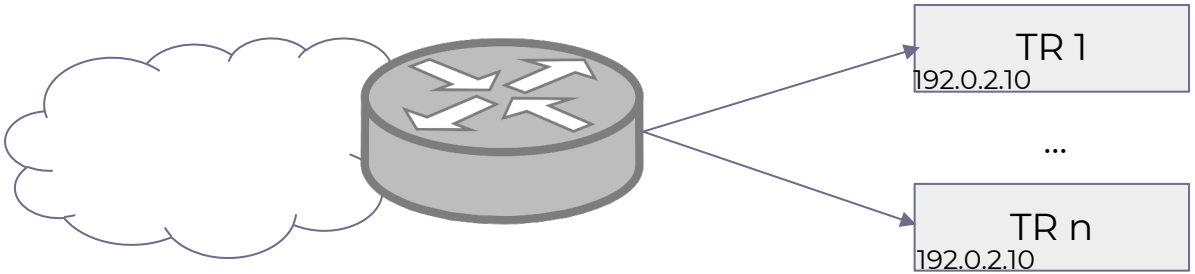
- Proof - Cache polling works
- Many pieces still under construction
  - IPv6
  - Multiple Interfaces sharing single IP- not bonding
  - Reporting as a single interface, with bandwidths summed

TLS Certificate Handling



- TLS keys/certs are stored in Control Plane
- Control Plane publishes Hitch PEM bundle and Traffic Router sslkeys.json
- Found a small bug in Subject Alternate Name wildcard matching

Anycast Traffic Routers



- DNS servers are often run using Anycast
- For Traffic Router, embedded DNS server must bind to port 53 TCP and UDP on the Anycast Virtual IPs
- TR listen IP configuration goes in dns.properties and server.xml

```
dns.udp.host=192.0.2.10
dns.tcp.host=192.0.2.10
```

Conclusion

- Varnish Cache’s flexibility leads to easy integration with ATC
- Will hopefully do an Open Source libvmod-astats contribution
- ORT cache-side config generation could be extended to generate VCLs

Questions?