The future of SSAI on OTT devices

Phil Cluff, July 2019

Background

Video ads on the internet, and the rise of SSAI.

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Video Adverts in browsers

- We started with client side advertising (CSAI). Experience was bad.
- Then the experience got better.
- Then Ad blockers were created.
- SSAI created on desktop a response to Ad blockers.

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OTT devices are different to browsers

- Higher viewer expectations of broadcast like experience
  - Fast startup times, no buffering between ads and content, no black frames, decent audio normalization…
  - It’s on a TV, right?
- Very few ad blockers though
- But devices have little RAM, little CPU, and useless browser engines
  - So CSAI isn’t super feasible

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How does SSAI work?

Manifest manipulation, timestamp rewriting, oh my!

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Approach 1: Manifest Manipulation based SSAI

- On manifest request, hit an ad server
- Check if you have those ads cached
- If so, insert them into the stream, along with markers
- If not, transcode them and hope they come up again later

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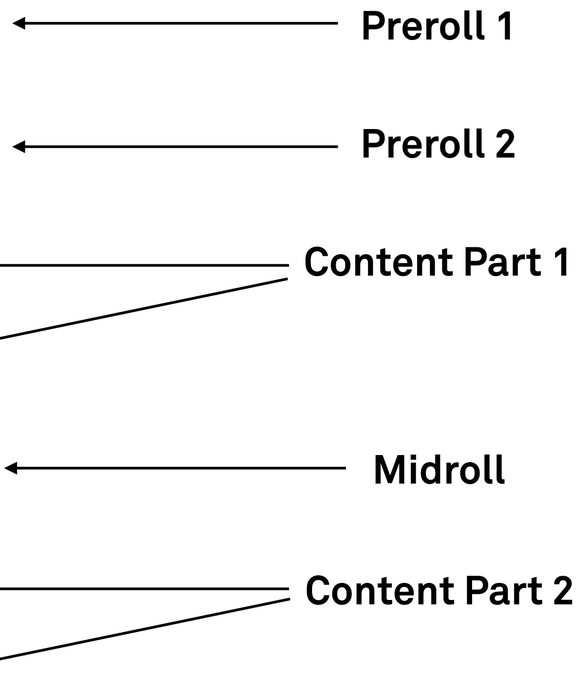
HLS Discontinuities

```
EXTM3U
#EXT-X-VERSION:3
#EXT-X-PLAYLIST-TYPE:VOD
#EXT-X-MEDIA-SEQUENCE:0
#EXT-X-TARGETDURATION:10
#EXTINF:10.000,
http://example.com/preroll-2/segment1.ts
#EXT-X-DISCONTINUITY
#EXTINF:5.000,
http://example.com/preroll-2/segment1.ts
#EXT-X-DISCONTINUITY
#EXTINF:10.000,
http://example.com/content/segment1.ts
#EXTINF:2.150,
http://example.com/content/segment2.ts
#EXT-X-DISCONTINUITY
#EXTINF:10.000,
http://example.com/midroll-1/segment1.ts
#EXT-X-DISCONTINUITY
#EXTINF:10.000,
http://example.com/content/segment3.ts
#EXTINF:5.067,
http://example.com/content/segment4.ts
#EXT-X-ENDLIST
```



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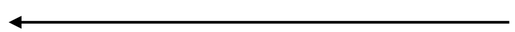
DASH Multi Period

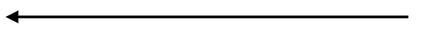
```
<?xml version="1.0" encoding="UTF-8"?>
<MPD xmlns="urn:mpeg:dash:schema:mpd:2011" profiles="urn:mpeg:dash:profile:isoff-live:2011"
type="static" mediaPresentationDuration="PT53.358S" minBufferTime="PT2.000S">
  <Period>
      <!-- Adaptation Sets, Roles, Segment Template,
           Segment Timeline Representations etc.  -->
  </Period>
  <Period>
           <!-- Adaptation Sets, Roles, Segment Template,
           Segment Timeline Representations etc.  -->
  </Period>
  <Period>
           <!-- Adaptation Sets, Roles, Segment Template,
           Segment Timeline Representations etc.  -->
  </Period>
  <Period>
           <!-- Adaptation Sets, Roles, Segment Template,
           Segment Timeline Representations etc.  -->
  </Period>
  <Period>
           <!-- Adaptation Sets, Roles, Segment Template,
           Segment Timeline Representations etc.  -->
  </Period>
</MPD>
```



Preroll 1

Preroll 2

Content Part 1



Midroll

Content Part 2

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Approach 2: Timestamp rewriting SSAI

- Still manipulates the manifest to insert ads, and generates a manifest for each user
- But also re-writes the timestamps of content and ads so that discontinuities aren’t required
- Usually requires redirects to segments
- Great for OTT devices, not so great for caches

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“Manifest manipulation sounds great!”

Let’s use it everywhere!

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The living room device landscape

AKA the good, the bad, and the ugly

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The 4 classes of device in the living room

- Streaming boxes
- “Smart” TVs
- Set top boxes
- Games consoles

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⚠️ Disclaimer ⚠️

These support grids are for European 2018/19 devices, trying to use the native video player, running up to date firmware.
YMWV.

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The Good: Streaming Boxes

Device	HLS with Discontinuities	HLS with Discontinuities and DRM (Fairplay)	Multi Period DASH	Multi Period DASH with DRM (Playready or Widevine)	Notes
chromecast	✅	❌	✅	✅	Use Cast Application Framework (CAF)
tv	✅	✅	❌	❌	HLS only. Native support.
Roku	✅	❌	✅	✅	Works with firmware 8.1 and up. Note that Roku based devices (EG: NowTV, TelstraTV) run outdated firmware for extended periods.
fire tv (Android TV)	✅	❌	✅	✅	Use Amazon's fork of Exoplayer.

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The Bad: “Smart” TVs

Device	HLS with Discontinuities	HLS with Discontinuities and DRM (Fairplay)	Multi Period DASH	Multi Period DASH with DRM (Playready or Widevine)	Notes
SAMSUNG	✅ (Natively)	❌	? (In theory via MSE)	? (In theory via MSE)	Modern Tizen only. There are mixed reports on workarounds to get multi period DASH working, in particular using a custom player, but it certainly doesn’t “just work”.
LG	✅ (Natively)	❌	✅ (Via MSE)	✅ (Via MSE & EME)	WebOS. Native playback is limited to HLS. Use a web player to get DASH and DRM playback. Multi-period depends on using a player that has support. DRM with multi-period seems to be hit-and-miss.
SONY	✅	❌	✅	✅	Android TV since 2015. Use Exoplayer, this should work just fine.
SHARP	✅ (On AndroidTV and RokuTV based devices)	❌	✅ (On AndroidTV and RokuTV based devices)	✅ (On AndroidTV and RokuTV based devices)	Sharp has some Android TV, some RokuTV based devices. These should just work, but we haven’t been able to confirm.
Panasonic	?	❌	✅ (Via MSE)	✅ (Via MSE & EME)	Firefox OS fork since 2014. HTML5 web app based. Should support HbbTV 2.0.1.
Hisense	✅	❌	✅	✅	RokuTV Based, should work as per Roku.
TCL	✅	❌	✅	✅	RokuTV Based, should work as per Roku.
VIZIO	?	❌	?	?	Devices used to be Chromecast based, but now are some form of streamed web app (they don't have Netflix yet...) Vizio also doesn't exist in the EU, so I don't really care.

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Results will vary largely based on how you build and distribute your application.

The Ugly: Set top boxes

- Thousands of devices in the market, varying by locale
- Very little support for DASH or DRM in general
- Most devices have no support for manifest manipulation

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The Forgotten: Games consoles

Device	HLS with Discontinuities	HLS with Discontinuities and DRM (Fairplay)	Multi Period DASH	Multi Period DASH with DRM (Playready or Widevine)	Notes
XBOX ONE	✅	❌	✅	✅	As reported by Microsoft, unverified.
PS4	✅	❌	❌	❌	Sony report this “should work”, but all practical attempts to use it seem to have failed in practice. May work with some custom player development.
NINTENDO SWITCH	?	?	?	?	I have had no success in contacting Nintendo about this. Streaming apps likely run in the web browser which is Webkit based.

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Device coverage by numbers

- Streaming boxes: 100%
- Smart TVs: 90%*
- Set top boxes: 🤷🏻‍♂️
- Games consoles: ~50?%

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* Again, remember this is for 2018/19 devices, with up-to-date firmware

Problems

99 problems, and Smart TVs are definitely one.

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This is an incomplete picture

- We have good device coverage, so we’re good, right?
- Not really. Only 42% of households in the UK “Have a Smart TV”*
- Uptake of streaming boxes is not large
- We have very little data on the age of the Smart TV devices in peoples homes

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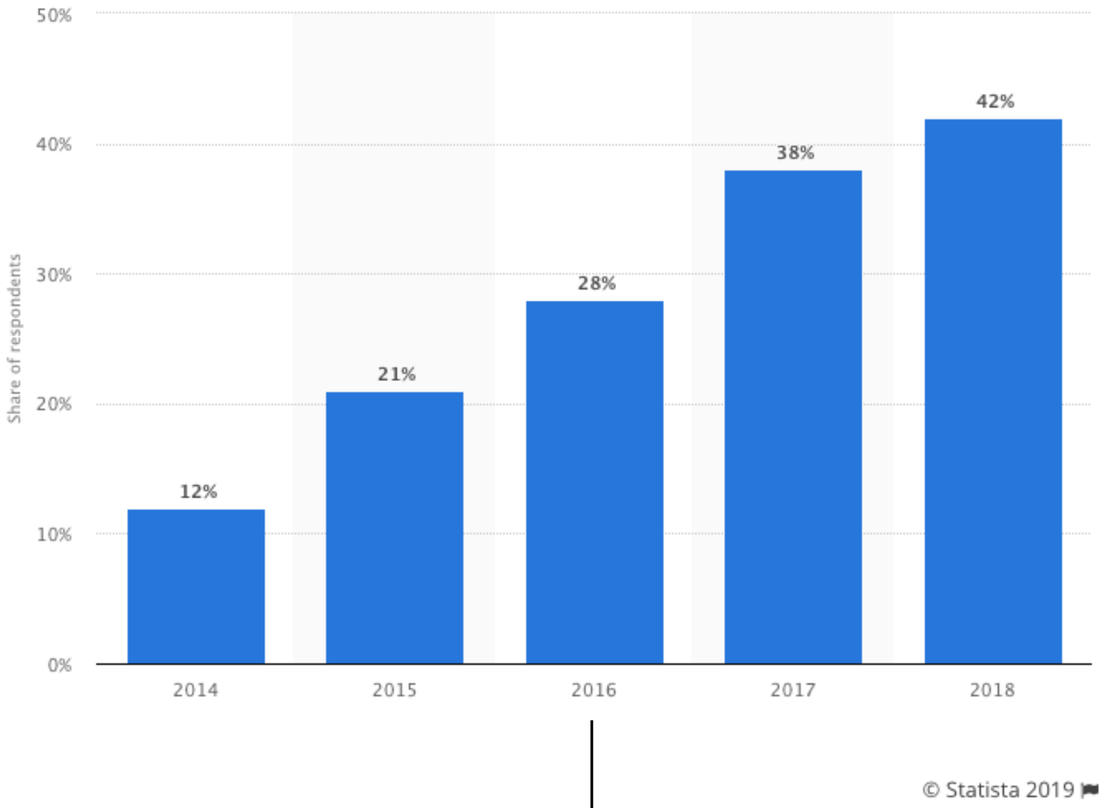
* Statista, 2018. European countries differ. I’m working on getting firmer statistics.

Age of Smart TVs

- While we don’t know absolute age, we can approximate from adoption rate
- Smart TV adoption is growing by average 6-7% a year, and is slowing
- Based on adoption rate, most Smart TVs are at least 3 years old



28% bought over 3 years ago

14% bought in the last 3 years

Old Smart TVs suck

- Capabilities trail off quickly for older Smart TVs
- Out of date firmware is common
  - These devices still have access to the app store
  - This can be hard to detect
- 3 years ago: Virtually no manifest manipulation support

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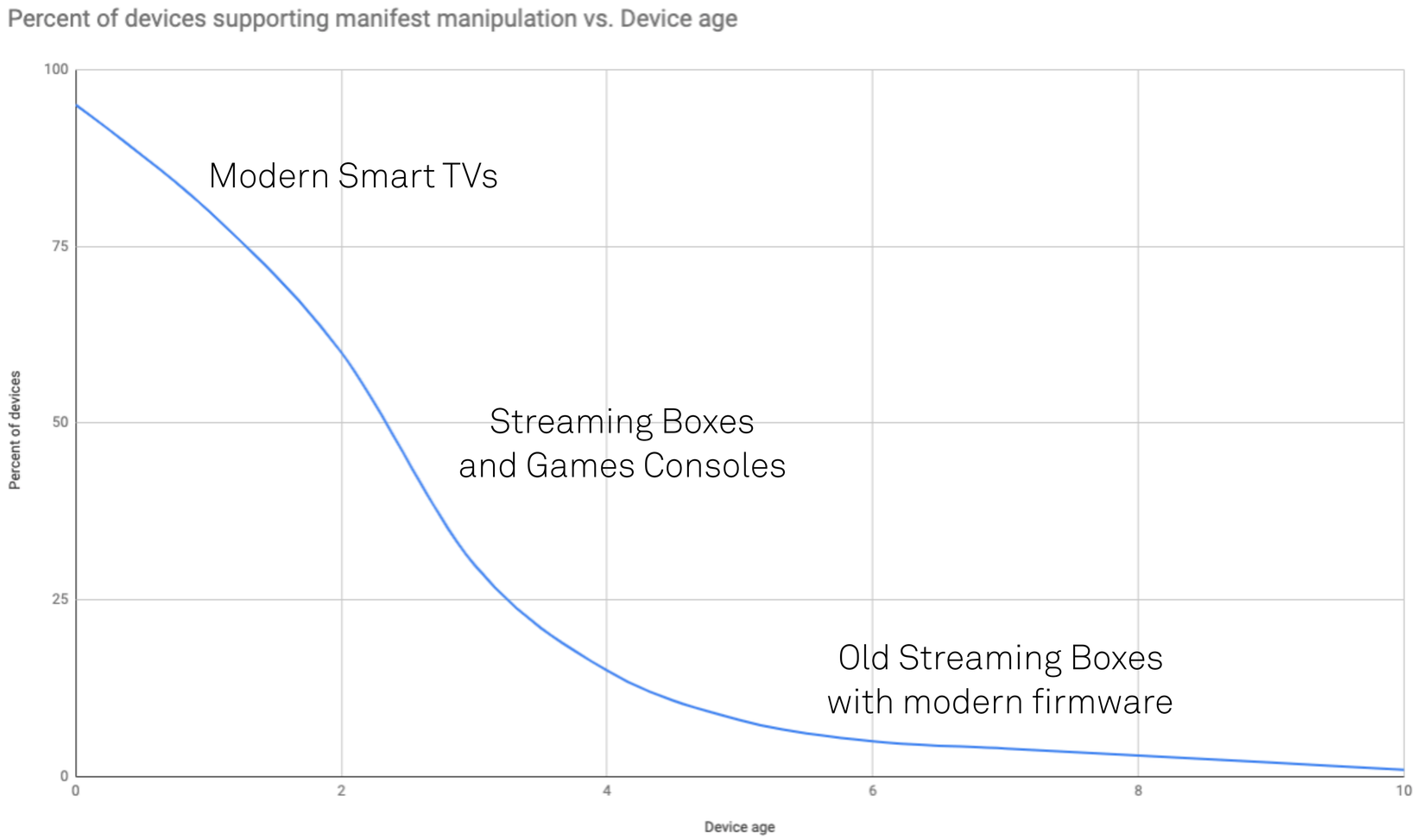
SSAI Support vs Device Age



Solutions

Probably what you came here for...

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First, understand the scope of your problem

- Figure out how much of a problem you have
- Survey your users, understand what devices they have in their living rooms
- Lots of people have many devices in their living room
- Example: I have 5 living room devices which can play Netflix, including a Smart TV
- And remember...

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In the nicest way...

You are not NETFLIX

And you shouldn't try to be...
Not yet anyway

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Fallback to no ad fill on old devices

- Some of these devices just aren’t worth the opportunity cost of targeting
  - What could you do with the time you’re wasting on making ads work on old devices with a limited lifespan?
- They might not even support DASH
  - Smooth was common for DRM’d content pre-DASH. Still popular.
- This will be unpopular with your business team
  - But once you understand the limited potential revenue you’re actually losing, you might care less
  - Do people with old TVs have a lot of disposal income?

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For some devices, DRM is the limiting factor

- Look at areas in your licensing restrictions where turning off DRM might be an option
  - Dropping the resolution lower than HD etc.
- Consider what’s more valuable, HD or ads?

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Send people Chromecasts

- Old devices will eventually cycle
  - Maybe you can accelerate that, particularly if you're talking about set-top-boxes
- There's relatively few upcoming drivers to upgrade Smart TVs
  - Lots of people can't see the difference between 1080p and 4k, let alone 8k

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Worst case: Server-side-stitching

- If you’re really really really sure you need those devices…
  - This comes with big penalties
    - Your cache performance will be very limited - 30%- 40% reduction
    - Your origin egress will increase dramatically
    - Your origin / edge compute requirements will increase dramatically
    - It won’t be frame accurate
    - It will be further from a “broadcast like” experience

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The future of SSAI

AKA Phil gets his crystal ball out.

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Upcoming standards may help

- HbbTV advertising standard is coming
  - Jon Piesing is working hard on this
- Adds requirements around available resources for mid-stream switching to ads and back again
- Trying to get back to a broadcast like experience
- But this is likely a few years away,
- Doesn’t help the US market.
- In the US, we need to rely on AndroidTV and RokuTV gaining traction

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The future of beacons with SSAI

- Beacons record ad viewership so you get paid
- Lots of SSAI solutions include server side beaconing
- Server-side beaconing is becoming less accepted by ad networks
- Hybrid SSAI and client SDKs / beaconing are becoming common
  - This is a problem because beacons get caught by ad blockers
  - Render the ad, and don’t get paid? Everyone loses.

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Growth in programatic

- Programatic is growing massively
- This will cause larger, less predictable ad catalogs
- This will slow down startup times
- This will make ad stitching even less effective

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Summary

What did y’all learn?

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Summary

- Smart TVs and set top boxes still suck at manifest manipulation based SSAI
  - But are getting much better in recent years
- It is best to target recent, up-to-date living room devices, and wait for the market to grow while you spend your time elsewhere
- You’re not Netflix
  - Be creative, be good at what you’re unique at, being on every device with ads isn’t critical
  - You should probably focus on mobile, QOE and streaming boxes before Smart TVs

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Thank you!

Questions? Corrections?

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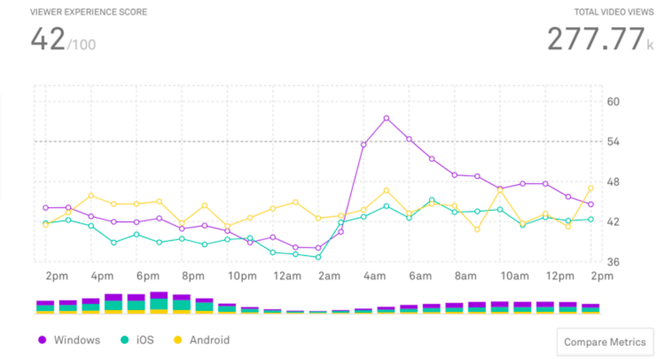
/data

Best-of-breed live and on-demand video streaming analytics.



/video

An API to build amazing video experiences for any team.