

# The Web Media Decade

*Anticipating the Unexpected*

*Global standards have transformed video consumption.  
What might happen next?*

John Simmons, Media Platform Architect, Microsoft





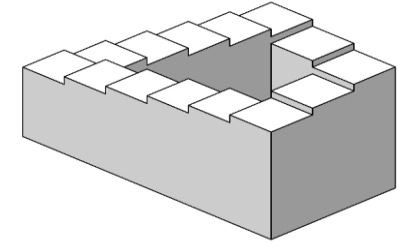
## The Decade of Web Media

The decade-long effort to define global Web media standards provides a clue about the future.



## What to Expect Next

The effort continues, not just improving the streaming experience, but also taking Web media portability closer to its eventual destination.



## Anticipating the Unexpected

Global Web media portability is a disruptive development. Are we approaching an inflection point? What can other disruptive technologies tell us about the future?

# The Web Media Decade

*John Simmons  
Microsoft Corp.  
May 22, 2019*



# The Web Media Decade

How a paradox raised in a 2003 United Nations report contributed to the development of commercial Web media portability.

In the Summer of 2007, while working on a paper on the future of DRM technologies, I came across a 2003 United Nations Report which described the following paradox:

*“The development of the Internet has ... created significant challenges to any distribution model which depends on scarcity... The application of technology to this problem must ... establish a point of scarcity on behalf of the rights holder.*

*However, this raises a **fundamental paradox** ... the business of publishers lies in providing access rather than in preventing it.*

*Nevertheless, unless copyright is to be abandoned as a mechanism for trading in intellectual property entirely, it will be essential to find an answer to this paradox.”*

WIPO Report: Current Developments in the Field of Digital Rights Management,  
prepared by Jeffrey P. Cunard, Keith Hill, and Chris Barlas,  
August 2003



**WIPO**

**WORLD INTELLECTUAL PROPERTY ORGANIZATION**



UNITED NATIONS

# Web Media Portability and the WIPO PARADOX

*The application of technology must **establish a point of scarcity** on behalf of the rights holder while **providing rather than preventing access.***



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May 22, 2019*

# Web Media Portability and the WIPO PARADOX

*If DRM-protected media was as portable as “in-the-clear” media, would that ‘application of technology’ solve the WIPO Paradox? And if so, how could this be done?*



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# Microsoft 2007 CLEAR Proposal

Sept 2007

**CLEAR** proposal to address the WIPO PARADOX by making DRM-protected content nearly as portable as in-the-clear content.

Jan 2009

To build support for common encryption, Microsoft proposed to the multi-DRM **Digital Entertainment Content Ecosystem (DECE)** that they adopt the DRM-interoperable **ATHENS** container for use in **Ultraviolet**.

Based on the **CLEAR** proposal, the **ATHENS** project begins engaging standards organizations to adopt a DRM-interoperable container optimized for adaptive delivery along with a standard for adaptive delivery.

Oct 2008

**DECE** adopts the **ATHENS** container format for use in **Ultraviolet**, requiring all DRMs to support what would later become the ISO/IEC **Common Encryption** specification.

June 2009

# 2008 ATHENS Project vision for Media Portability

The ATHENS team planned a multi-layer standardization engagement strategy to make commercial Web media nearly as portable as “in-the-clear” content, with a plan to engage MPEG, 3GPP, W3C and IETF.

ATHENS began with the most difficult problem at that time - convincing DRM providers and device manufacturers To embrace DRM-interoperability.

HTML Extensions for adaptive delivery

HTML Extensions for DRM signaling

RESTful AuthN and AuthZ Standards

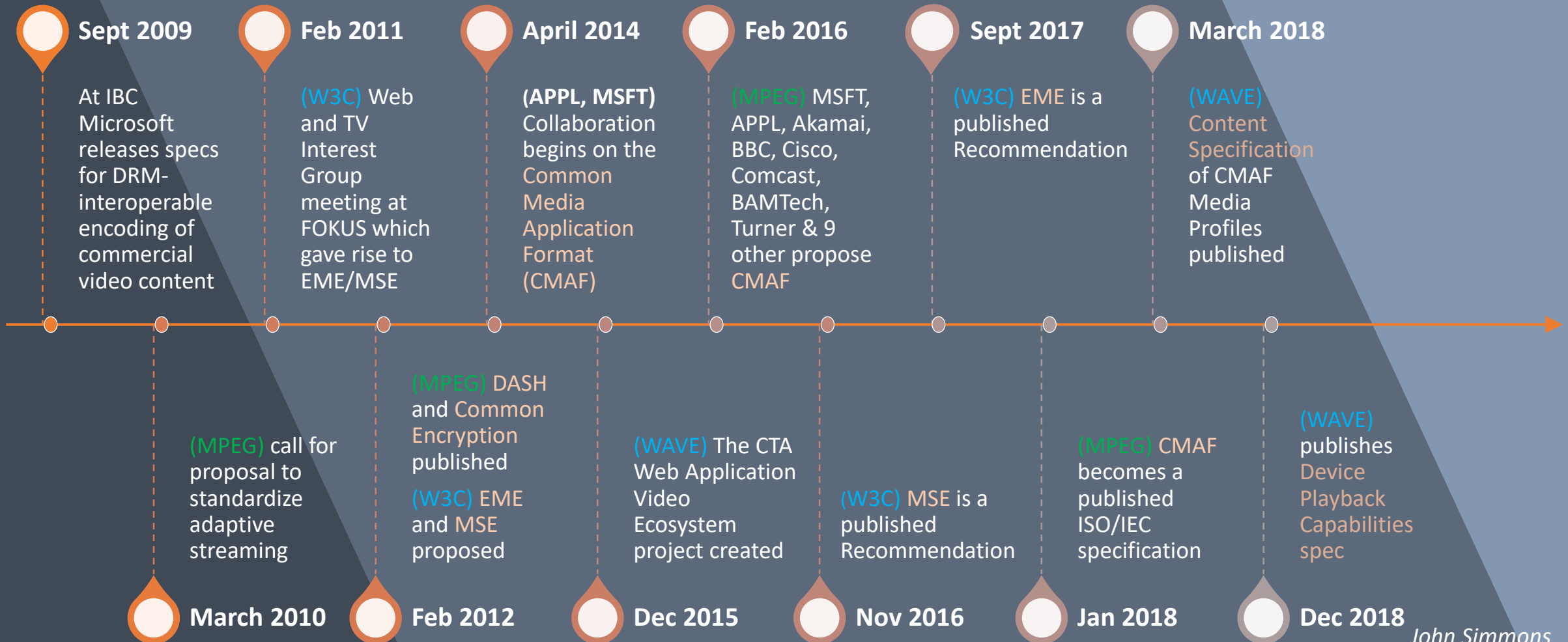
Adaptive Delivery protocol standard

Adaptive container format supporting DRM-interop standard

DRM-interoperable Encryption Standard



# Milestones for Web Media Portability



Cross-platform Progressive  
Web Apps (PWAs)

Web Workers and Web App Manifest – W3C & WHATWG

JavaScript control of adaptive  
streaming

HTML5 Media Source Extensions (MSE) – W3C

JavaScript interaction with DRM

HTML5 Encrypted Media Extensions (EME) – W3C

Industry standard manifest (m3u8)

HTTP Live Streaming (HLS) - Apple published in IETF

Industry standard manifest (mpd)

Dynamic Adaptive Streaming over HTTP - ISO MPEG DASH

Manifest independent live-  
linear and on-demand encoding

Common Media Application Format – ISO MPEG CMAF

DRM-Interop encode/decode

Common Encryption for fragmented MP4 - ISO MPEG CENC

**Web App Manifest**, W3C Working Draft 08 May 2018,  
[www.w3.org/TR/appmanifest/](http://www.w3.org/TR/appmanifest/)

Web Workers and Web App Manifest – W3C & WHATWG

**Media Source Extensions**, W3C Recommendation 17 November 2016,  
<http://www.w3.org/TR/media-source/>

HTML5 Media Source Extensions (MSE) – W3C

**Encrypted Media Extensions**, W3C Recommendation 18 September 2017,  
<http://www.w3.org/TR/encrypted-media/>

HTML5 Encrypted Media Extensions (EME) – W3C

**HTTP Live Streaming (HLS)**, RFC8216, <https://tools.ietf.org/html/rfc8216>

HTTP Live Streaming (HLS) - Apple published in IETF

ISO/IEC 23009-1:2014, Information technology – **Dynamic adaptive streaming over HTTP (DASH)** – Part 1: Media presentation description and segment formats,  
<https://www.iso.org/standard/65274.html>

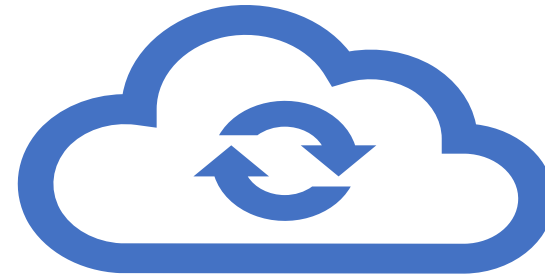
Dynamic Adaptive Streaming over HTTP - ISO MPEG DASH

ISO/IEC 23000-19, Information technology — Coding of audio-visual objects — Part 19: **Common media application format (CMAF)** for segmented media.  
<https://www.iso.org/standard/71975.html>

Common Media Application Format – ISO MPEG CMAF

ISO/IEC 23001-7:2016, Information technology – MPEG systems technologies – Part 7: **Common encryption** in ISO base media file format files,  
<https://www.iso.org/standard/68042.html>

Common Encryption for fragmented MP4 - ISO MPEG CENC



# What to Expect Next

A brief survey of some important work, categorized in a way which may suggest what the future will bring.



## IMPROVED MEDIA EXPERIENCE

- Low latency, codec switching in MSE - [W3C MWG](#), [WICG](#)
- Encoding for low latency streaming - [DASH IF](#), [MPEG](#)
- File System Access for offline video - [W3C MWG](#), [WICG](#)
- DataCue & Timed Metadata - [W3C MEIG](#), [WICG](#), [MWG](#)
- Changes to HTML5 for 5G - [W3C Web & Networks IG](#) \*
- Codec advances - [MPEG](#) (VVC, EVC), [AOM](#) (AV1, AV2)
- Analytics, scene recognition - *industry wide*
- Machine learning for adaptive delivery - *industry wide*

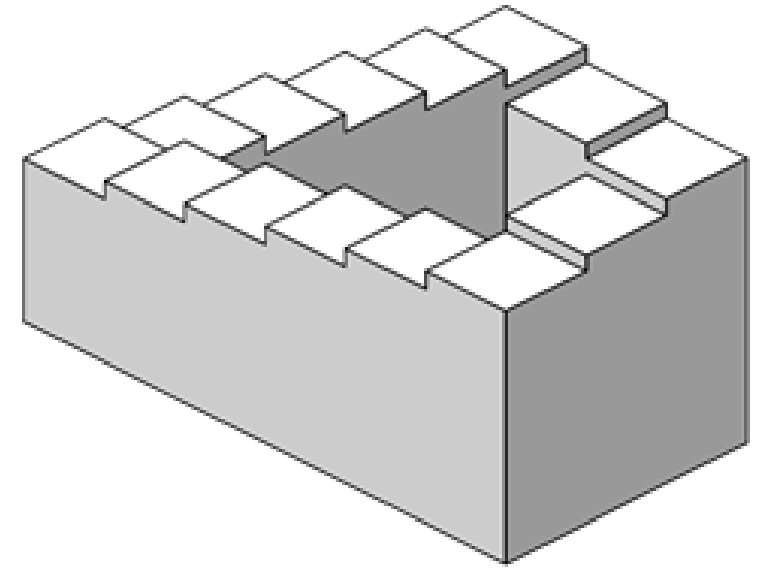
This work provides important improvements but will impact the future in a predictable way *except* \*



## IMPROVED PORTABILITY

- Media Capability Reporting - [W3C MWG](#), [WICG](#)
- CMAF Byte Stream Format - [W3C MWG](#), [WICG](#), [WAVE](#)
- Encoding CMAF for DASH-HLS interop - [WAVE](#)
- Standards for Dynamic Ad Insertion - [DASH IF](#)
- Splice conditioning rules - [WAVE](#), [MPEG](#)
- Device playback requirements - [WAVE](#)
- Device playback testing - [WAVE](#)
- Content Test Frameworks - [DASH-IF](#), [DVB](#), [WAVE](#)

The improvement of Web Media portability is a disruptive technological development.

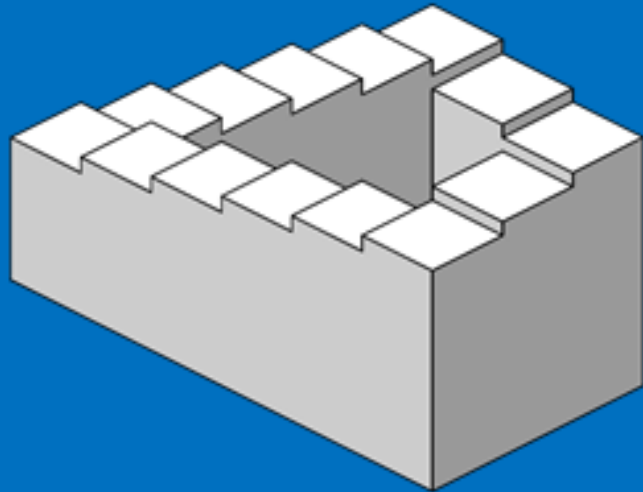


# Anticipating the Unexpected

Web Media Portability is disruptive. What can Internet/Web history suggest about the future? Will cord cobbling be replaced by super aggregators? Or by something else, something unexpected?

# Anticipating the Unexpected

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## WEB MEDIA PORTABILITY

- A key goal of the Web Media Decade was making commercial media content portable across devices on the Web.
- Much of that work is complete, but more work remains, and as a result we have yet to see the full disruptive impact of commercial media portability.

## DISRUPTIVE TECHNOLOGY

- What is a disruptive technology?
- Have we seen something similar before and what might it tell us about the future of Web media?

“The strategic inflection point is the time to wake up and listen”

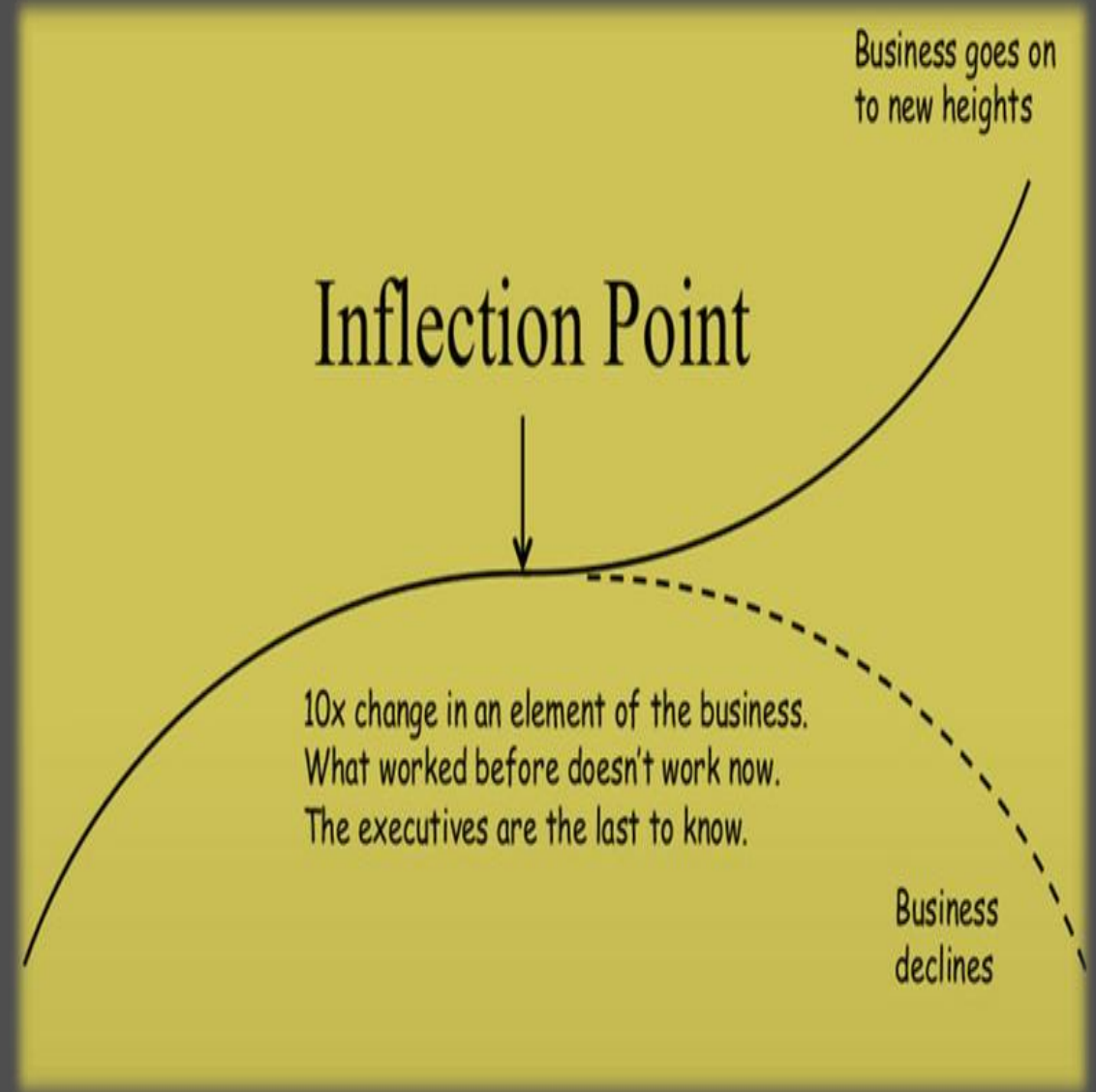
“You can be the subject of a strategic inflection point, but you can also be the cause of one”

“In technology, whatever can be done will be done”

“People in the trenches are usually in touch with impending changes early”

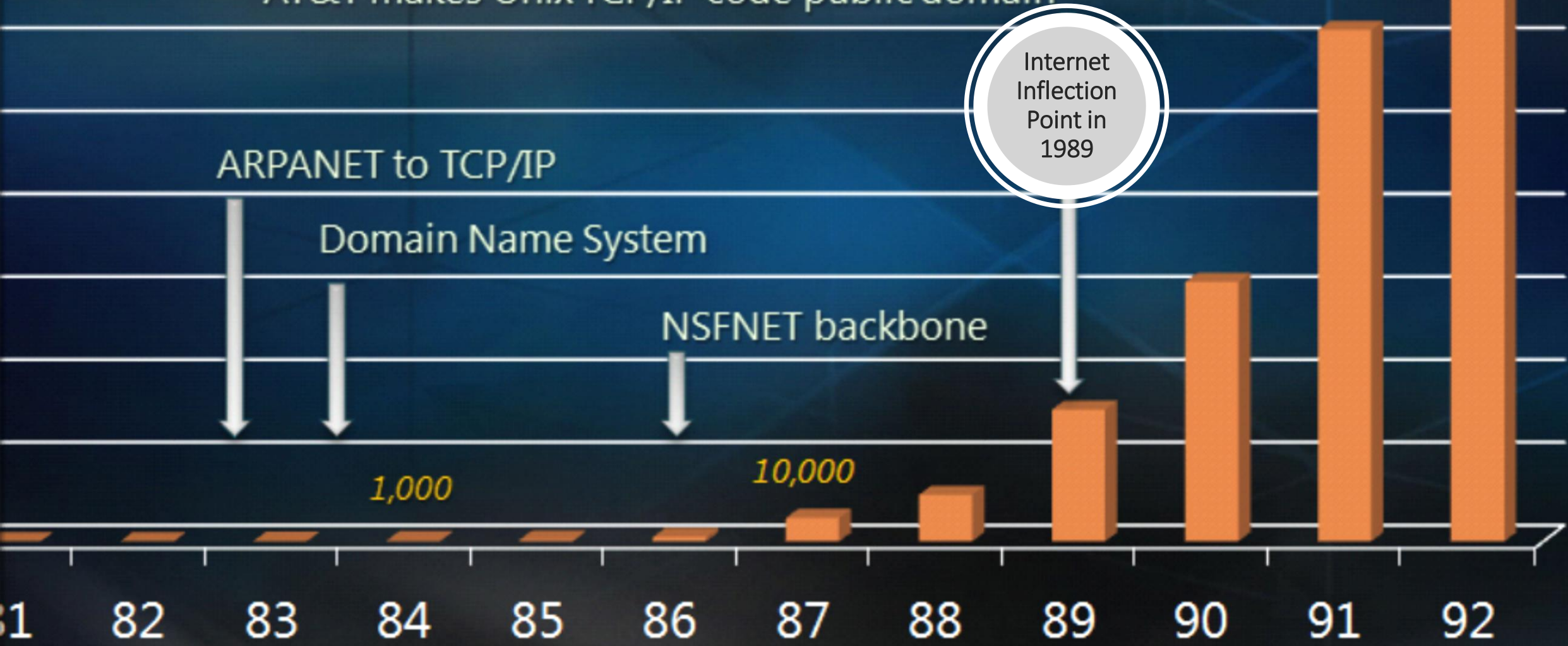
— Andrew S. Grove, *Only the Paranoid Survive*

The Web Media Portability inflection point has features in common with both the Internet & World Wide Web inflection points.

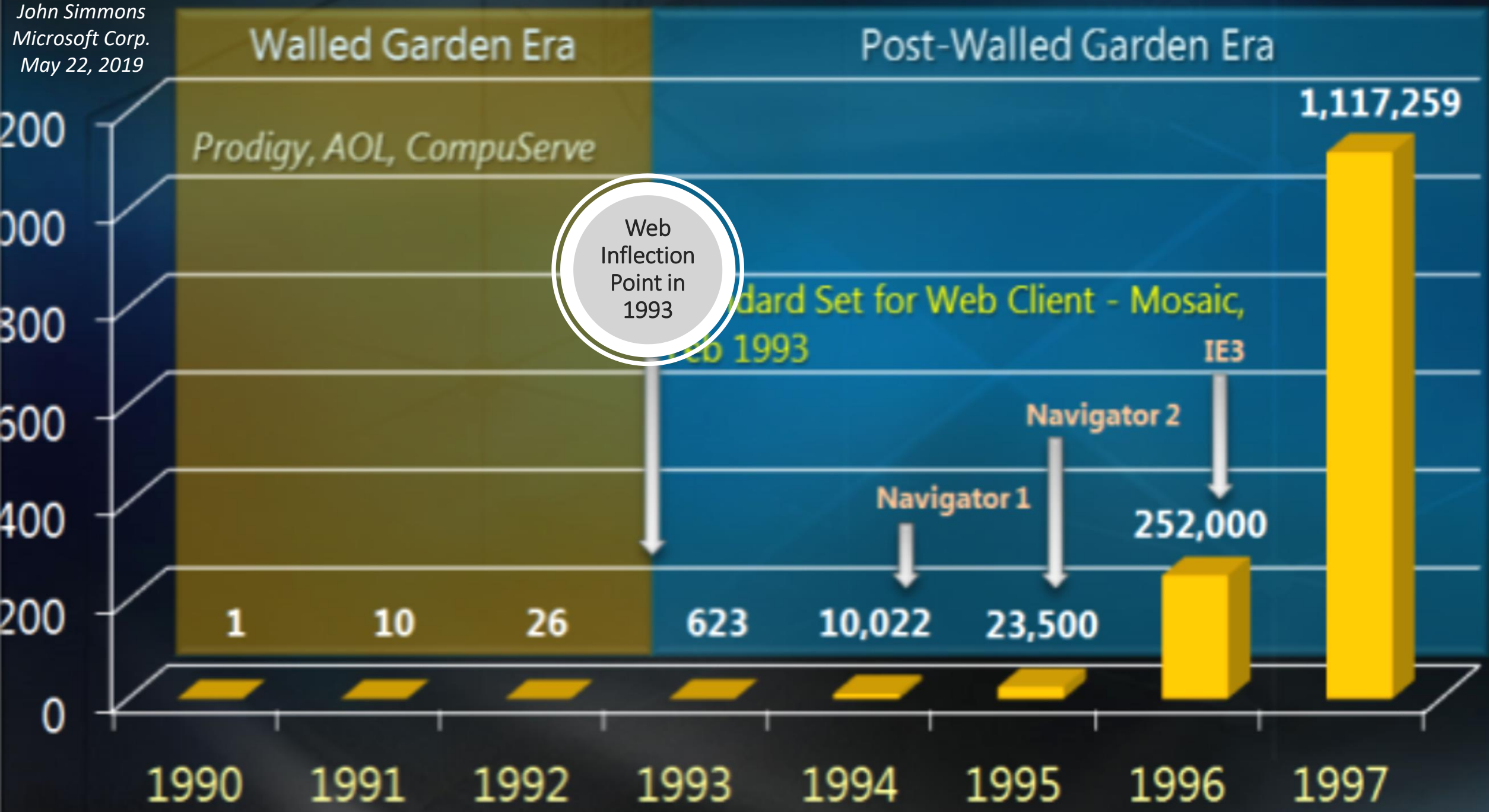




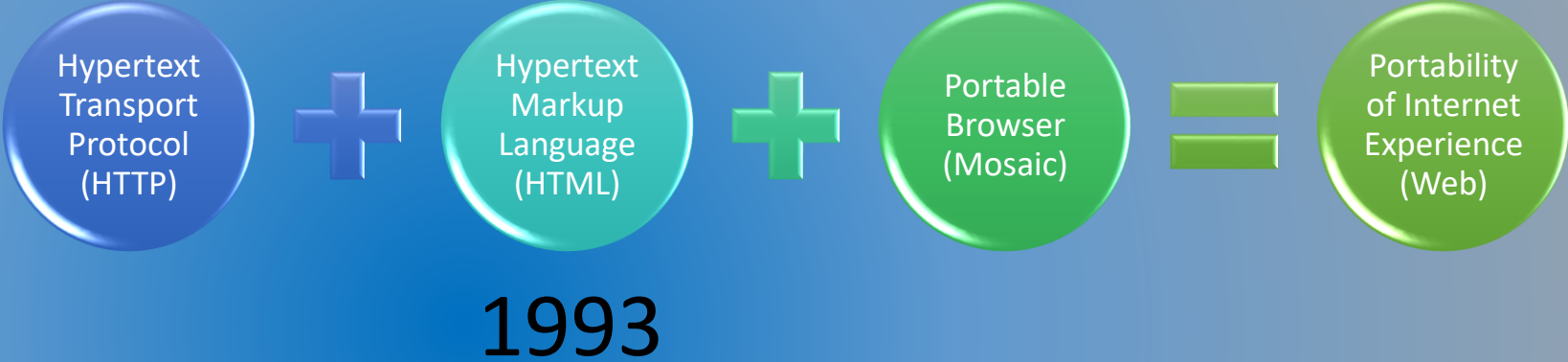
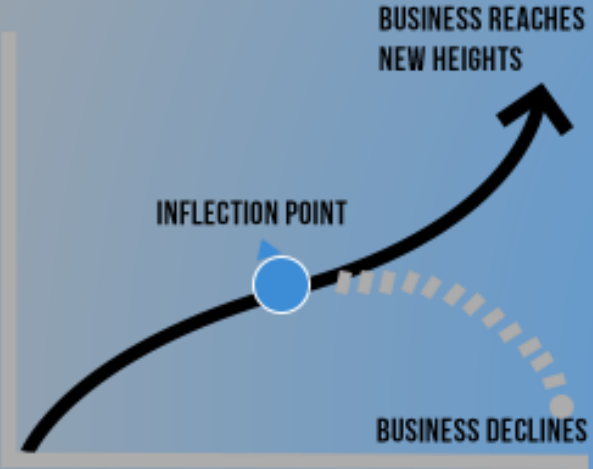
AT&T makes Unix TCP/IP code public domain

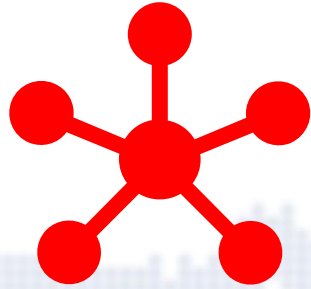


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# Global Web Media Portability Inflection Point





## Traditional Media

Closed ecosystem

Regional

Device component requirements

Device interaction defined

Value chain is narrow at the top

Curated content

Single Authorization Provider



## Web Media

Open ecosystem

Global

Device feature detection

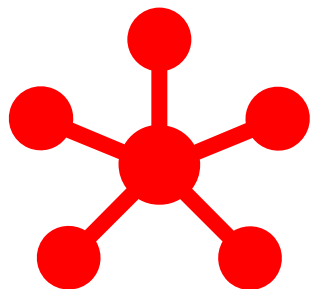
Device interaction enabled

Value chain is wide at the top

Content discovery

Multiple Authorization Providers

# TODAY

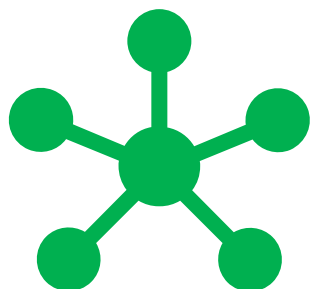


Traditional Media MVPDs provide curated content combining playback and discovery in a single framework and a single authorization credential. **A traditional walled garden.**



Cobbled OTT services provides curated content without a common playback and discover framework and requiring multiple authorization credentials. **Lots of small walled gardens.**

# The FUTURE?



Traditional Media vMVPDs and OTT aggregators provide curated content combining playback and discovery in a single app framework with a single authorization credential. **A very large walled garden with tenant farmers.**



Cloud services which combine playback and discovery in a single app framework with cloud-stored, AuthN-linked, AuthZ tokens. **A personalized Web Media browser.**

# Three Tiers of Commercial Web Media



**Tier-1 mainstream:** linear content from cable/satellite/telco, most popular and limited in variety because linear is bandwidth constrained

**Tier-2 direct-to-consumer:** Tier-1 channels or channel programs going direct to consumer. Inherit interop challenge.

**Tier-3 Long tail:** vertical niche content made practical by global Internet standards for commercial media which are cloud addressable objects. “Farm league” for linear content.

Niche Market

Mass Market



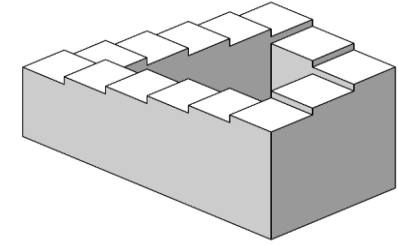
## The Decade of Web Media

Making Web Media nearly as portable as “in-the-clear” media was an unstated goal of the decade of Global Web Media Standardization.



## What to Expect Next

Efforts underway to meet that portability goal can have a disruptive impact on commercial video consumption.



## Anticipating the Unexpected

OTT DTC providers and vMVPD channel aggregators may be disrupted by the growth of long tail commercial content, making way for personalized Web Media browsers.

# Concluding Thoughts

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Thank You





