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HTTP Streaming: Standard for Age-Appropriate Video Content Guidelines (VCG) and Delivery

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Abstract

The delivery of inappropriate video content for OTT and Social Media with HTTP video streaming is a serious worldwide problem. Most of the countries have established age-related and parental guidelines to warn about inappropriate or unintended content, particularly for children. However, these guidelines do not offer the freedom or convenience for audiences to avoid consumption of inappropriate content for their target age group instead just provide warning messages only.The Age-Relevant Video Content Guidelines (VCG) Standard defines a standard meta data format which covers fully and partially scene by scene age relevancy meta data for video and audio content and hence establishes a mechanism for delivering video and audio content tailored to the viewers' age groups.

The Video Content Guidelines(VCG) is a meta data file which can enable existing HTTP based adaptive streaming standard like HLS, DASH, CMAF, MSS and HDS with updating manifest file using VCG meta data, that ensures only the target age-appropriate content is delivered to the audience and in-appropriate data can be skipped or modified so that different age group audience can choose what they want to watch. This ensures the compatibility of with the standard adaptive streaming protocols and players, so that the existing social Media and OTT streaming infrastructure continue to work without any major changes.

Status of This Memo

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1. Introduction

HTTP-based streaming protocols have revolutionized the way video content is delivered over the internet, offering seamless playback and adaptability across diverse devices and network conditions. Key protocols include HLS (HTTP Live Streaming), developed by Apple, which is widely used for adaptive bitrate streaming across Apple devices and beyond. DASH (Dynamic Adaptive Streaming over HTTP), an open standard, enables platform-agnostic delivery of high-quality video content. MSS (Microsoft Smooth Streaming), designed by Microsoft, supports adaptive streaming for Windows-based platforms. CMAF (Common Media Application Format) streamlines video delivery by standardizing media segments across HLS and DASH, improving interoperability and reducing storage costs. Lastly, HDS (HTTP Dynamic Streaming), introduced by Adobe, utilizes HTTP for adaptive delivery of high- quality content. These protocols leverage chunk-based delivery and adaptive streaming principles to ensure optimized performance, scalability, and compatibility with modern HTTP versions, including HTTP/1.1, HTTP/2, and HTTP/3.[HTTP/1.1], [HTTP/2] and [HTTP/3].

Modern HTTP-based streaming protocols, such as HLS, DASH, MSS, CMAF, and HDS, offer significant advantages over older content viewing models like DVDs, cable TV, or early static streaming. These protocols enable adaptive streaming, dynamically adjusting video quality to match network conditions for uninterrupted playback. They provide on-demand access, allowing viewers to watch content anytime, and leverage HTTP infrastructure like CDNs for scalability, supporting global audiences efficiently.

Their compatibility with diverse devices, including TV, smartphones, tablets, and browsers, ensures accessibility for users across platforms. By delivering content in small chunks, these protocols optimize bandwidth usage and lower costs by eliminating the need for specialized servers. Advanced features such as live streaming, subtitles, and multi-language support enhance user engagement, while encryption and DRM offer robust content protection. Furthermore, standardized protocols like DASH and CMAF ensure interoperability, reducing fragmentation and improving the viewing experience. These innovations make HTTP-based streaming far more efficient, flexible, and secure than traditional methods.

Although conventional adaptive streaming protocols offer the convenience of on-demand access, they fall short in establishing standards for content relevance. Specifically, they lack a built-in mechanism to ensure that viewers are only exposed to content suitable for their specific age group. This gap highlights the need for more robust frameworks that can effectively manage age-appropriate content delivery within streaming platforms

1.1 Lack of standard for Age-Appropriate Content

Although HTTP-based streaming protocols like HLS, DASH, MSS, CMAF, and HDS provide the convenience of on-demand access, they lack a built-in mechanism to ensure viewers only watch content relevant to their age group. These protocols focus on delivering high-quality adaptive streaming but do not inherently address age-specific content restrictions. This creates a gap in ensuring a safe and age-appropriate viewing environment, especially for children. As a result, there is a growing need for age-relevant content definition standards to work with existing streaming protocols, ensuring seamless access to appropriate content while maintaining the benefits of adaptive and on-demand viewing.

1.2 Global Age-Related Content Regulations and Their Challenges

Different countries and regions worldwide have established age-related content regulations to safeguard viewers, especially children, from inappropriate material. In the United States, systems like MPAA ratings (G, PG, R, etc.) and TV Parental Guidelines are widely used. In Europe, the PEGI system for games and BBFC ratings in the UK provide detailed classifications, while countries like Germany and France have additional national standards. Russia implements strict age-based content ratings (e.g., 0+, 6+, 12+, 16+, 18+), with heavy censorship for non-compliance.

The United Arab Emirates (UAE) enforces strict content laws influenced by cultural and religious values, often banning or heavily editing content deemed inappropriate. India uses classifications like U, U/A, and A for movies and shows, and recently introduced OTT-specific

guidelines. China applies heavy censorship, banning content that violates political, moral, or cultural norms. Japan categorizes content under systems like R15+ and R18+, primarily for films and games. Similarly, Australia uses ratings such as G, PG, M, MA15+, and R18+, which are strictly enforced. While guidelines exist, enforcement often depends on self-regulation, which may leave gaps in compliance.

1.3 Challenges for streaming Platforms

When governments approach OTT platform providers or content creators to produce content suitable for all age groups, they often face resistance. Creators argue that such restrictions hinder their creative freedom and storytelling, as complex themes and mature topics cannot be explored within the confines of universally watchable content. They believe that catering to a wide age group dilutes the narrative depth, making it less appealing to specific audiences. OTT platforms also highlight the need for diverse content to serve varied audience preferences, ranging from children to adults. Restricting content to be family-friendly limits their ability to explore bold, experimental, or culturally relevant themes. Additionally, content designed for all ages may not perform well commercially, impacting viewership metrics and revenue. Platforms and creators often advocate for age-specific ratings and parental controls as a better solution, allowing them to maintain creative integrity while enabling audiences to make informed choices. This debate underscores the challenge of balancing artistic expression with regulatory compliance and societal concerns.

1.4. Conventions and Definitions

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.
This document uses the terms "client", and "server" from Section 3.3 of [HTTP]

2 Mechanism

In adaptive streaming, by utilizing segment-based data representation, each segment acts as an independent entity and a switchable point. This structure allows the creation of different playlists or manifest files, which can either maintain the same compressed data or offer varied file segments as needed. This flexibility enables viewers to select age-appropriate content based on their preferences. It gives content creators, platforms, and audiences more control over choosing suitable material for family viewing. As a result, governments can ensure that all content is accessible to viewers while providing mechanisms for individuals to select only the content that is appropriate for their age, allowing them to watch it at their convenience.

The metadata file can be generated either manually by humans or automatically by AI, signalling the timelines and marking content as appropriate for specific target age groups. This approach offers flexibility, allowing content creators and platforms to define their own classification levels, names, and criteria for age-relevant content. Whether human- generated or AI-driven, the metadata can provide detailed tags or markers that align with different age groups, offering an adaptable framework to ensure that viewers can easily access same content suited to their preferences and needs. This system enhances customization while ensuring that content meets regulatory guidelines for age-based suitability.

The manifest file and the meta data file can generate multiple manifest files which have video and audio segments which are suitable for that age group only and rest can be skipped or presented with modified static or dynamic data.

2.1 Meta data file format
Below is the sample meta data file for Video Content Guidelines.

Example VCG file content

```
VCG
00:00:00.000 --> 00:00:06.000
Video:L1_ALLAGE:Audio:L1_ALLAGE
00:00:06.000 --> 00:00:46.000
Video:L3_13PLUS:Audio:L3_13PLUS
00:00:46.000 --> 00:01:30.000
Video:L1_ALLAGE:Audio:L1_ALLAGE
00:01:30.000 --> 00:01:50.000
Video:L5_18PLUS:Audio:L5_18PLUS
00:01:50.000 --> 00:02:40.000
Video:L2_07PLUS:Audio:L2_07PLUS
00:02:40.000 --> 00:02:52.000
Video:L5_18PLUS:Audio:L5_18PLUS
00:02:52.000 --> 00:03:20.000
Video:L3_13PLUS:Audio:L3_13PLUS
00:03:20.000 --> 00:03:30.000
Video:L4_16PLUS:Audio:L4_16PLUS
00:03:30.000 --> 00:03:46.000
Video:L1_ALLAGE:Audio:L1_ALLAGE
00:03:46.000 --> 00:03:50.000
Video:L4_16PLUS:Audio:L3_16PLUS
00:03:50.000 --> 00:04:02.000
Video:L1_ALLAGE:Audio:L1_ALLAGE
00:04:02.000 --> 00:04:14.000
Video:L4_16PLUS:Audio:L3_16PLUS
00:04:14.000 --> 00:05:10.000
Video:L1_ALLAGE:Audio:L1_ALLAGE
00:05:10.000 --> 00:05:12.000
Video:L4_16PLUS:Audio:L3_16PLUS
00:05:12.000 --> 00:05:22.000
Video:L1_ALLAGE:Audio:L1_ALLAGE
VCG_END
```


Meta Data file MUST start with keyword VCG (Video Content Guidelines)and MUST end with keyword VCG_END. Next field is time period representing start time and end time of the video scene. It MUST be in the format Hours:Minutes:Seconds:mili seconds in HH:MM:SS:mmm format for respective scene.

The start and end time lines MUST be separated by a gap(space) and arrow --> and a gap (space) Next line MUST consist of two fields Video and Audio. The Video keyword MUST be followed by a colon(:) and VCG level followed by underscore (_) and MUST have 6 characters which MAY have any custom information

L#_xxxxxx (L then number(0 to 6 or more too) then underscore and 6 character code)

These formats are defined to standardize it across different adaptive streaming formats as well as players if clients support then different players can adopt to it for playout

Again no need to define entire time details also. Can define partial information as below, where rest of the duration considered as suitable for all groups (that is L1_XXXXXX) by default .

VCG
00:03:20.000 --> 00:03:30.000
Video:L4_16PLUS:Audio:L4_16PLUS
VCG_END

above data maps to L4 manifest file has all the segments and L1 , L2 and L3 will have all segments excepts segments from 3 min 20 seconds to 3 min 30 seconds. The exclusively not defined segments considered as L1 VCG category that is L1_ALLAGE (Suitable for all age group)

2.2 Meta data Levels and interpretations L0 : Not appropriate for all audience(L0_BANNED not shown to any one : not suitable for all in the target audience region)

L1 : Suitable for all age groups (can be marked as L1_ALLAGE or L1_UUUUUU etc.....) so all age group audience can watch these scenes. The scenes(segments) which are in-appropriate for this age group can not be seen with the generated L1 manifest file.

L2 : Suitable for audience above certain age (L2_07PLUS or L2_05PLUS) The resulting manifest files contains all L1 contents and also more scenes which kids of 7Plus or 5plus age can watch as per the requirement. The definition of age and segments is flexible and each country can define required number of manifests and age groups

L3 : Suitable for audience above certain age (L2_12PLUS or L2_10PLUS) similar to above the resulting manifest files contains L2 contents and also more scenes which kids of 12Plus or 10plus age can watch.

Similarly L4_14PLUS or L4_16PLUS and L5_18PLUS or L5_21PLUS defined based on the country and region.

The L0 to L5 are standard keywords the _extensions can be defined by

individual countries or regions as per their need.

Referring to above example data first entry is from time duration 0 sec to 6(5.999) seconds is suitable for all age groups(since marked as L1_). And second entry from 6 seconds to 46(45.999) seconds suitable for L3_13PLUS (and shall be streamed to L3 specific age here it is 13 years and above and must not be presented for age group of L1 and L2 category)

For example MPAA Film Ratings (for Movies) The Motion Picture Association of America (MPAA) provides film ratings, which OTT platforms often adopt for movies. These include: G: General audiences PG: Parental guidance suggested PG-13: Parents strongly cautioned : content may not be suitable for children under 13 R: Restricted : under 17 requires accompanying parent or adult guardian NC-17: No one 17 and under admitted

Can define L0_BANNED , L1_GENAUD(or L1_GGGGGG) , L2_PG0014(or L2_14PLUS) , L3_RSCTED , L4_NC0017 or (L4_17PLUS)

Similarly in India

Traditional film content in India is regulated by the Central Board of Film Certification (CBFC), which assigns age ratings for movies shown in

theatres. These ratings are also often used by OTT platforms for film content: U: Universal : suitable for all ages U/A 7+: Parental guidance for children below 7 years U/A 13+: Parental guidance for children below 13 years A: Adult : restricted to 18 years and above

Can define L0_NANANA , L1_UUUUUU (or L1_ALLAGE) , L2_07PLUS , L3_13PLUS , L4_18PLUS

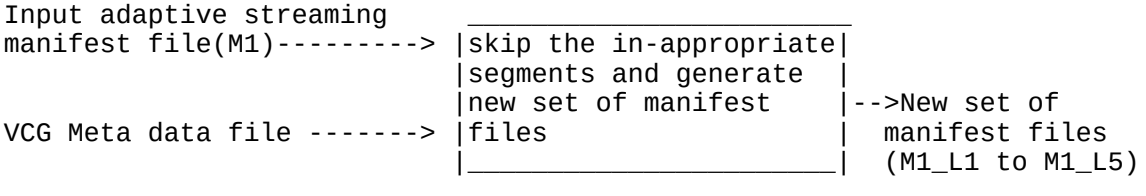
last 6 letters can be defined as per the need.

Similarly Audio specific levels can be defined and used appropriately.

2.3 server side

For a given video file, once segments and manifest files are generated in formats such as HLS, DASH, MSS, CMAF, or HDS, a post-processing module can analyze the corresponding VCG metadata and manifest files. Based on platform-specific preferences, it can then generate the required number of updated manifest files by removing inappropriate segments, replacing them with static standard segments, or inserting blurred or modified versions. The adaptive streaming manifests also support mechanisms to skip inappropriate segments dynamically during playback.

HLS (HTTP Live Streaming): Supports skipping segments using #EXT-X-SKIP in Low-Latency HLS (LL-HLS), and handles discontinuities with #EXT-X-DISCONTINUITY for switching between different streams or timelines. DASH (Dynamic Adaptive Streaming over HTTP): Enables skipping segments via Timeline or SegmentTemplate in the MPD and manages discontinuities using Period elements or UTCTiming updates. MSS (Microsoft Smooth Streaming): Allows skipping chunks through c elements in the manifest and handles discontinuities by specifying different chunks or quality streams within the same timeline. CMAF (Common Media Application Format): Facilitates skipping with time-based addressing while ensuring seamless discontinuity handling via precise chunk metadata and compatibility with DASH and HLS. HDS (HTTP Dynamic Streaming): Supports fragment skipping via the f4m manifest’s fragment index and handles discontinuities using bootstrap updates for timeline changes.



2.4 client or player side

Along with master manifest file respective VCG file can be shared where the player can skip the segments which are in-appropriate for the target audience based on the login profile of the audience or the audience preference. With discontinuity feature support on server and client side this feature can be very well supported as all the standards provide the provision is there for packagers and players for the same as defined by the standard.

3 Advantageous This standard VCG file helps in protecting children ad

vulnerable audience from viewing in-appropriate content This format standardises which helps to follow common protocol for various adaptive streaming formats or players based on the offerings This helps the audience where they have wide variety of content to watch with filtered content versions where they can choose what version of the content they want to watch, whenever they want

VCG format helps content creators as they have wide range of audience as different versions are presented to different age audience without any constraints on presentation/ creativity The OTT platforms also benefitted as instead of classifying entire episodes or movies as inappropriate for certain age groups, they will make available all the content with different age filters.

The Government or Guideline bodies are also benefited as their aim of protecting children and from in-appropriate content can be achieved with freedom to watch all contents.

4. Security Considerations

This document does not discuss security issues related to HTTP delivery, as these topics are expected to be discussed in the WG

5. IANA Considerations

This document does not require any actions from IANA

6. References

6.1. Normative References

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[HTTP/1.1] Fielding, R., Ed., Nottingham, M., Ed., and J. Reschke, Ed., "HTTP/1.1", STD 99, RFC 9112, DOI 10.17487/RFC9112, June 2022, <https://www.rfc-editor.org/rfc/rfc9112>.

[TV Parental Guidelines] The TV Parental Guidelines system for the United States is a voluntary-participation system for TV programs <https://rating-system.fandom.com/wiki/TV_Parental_Guidelines>

[CBFC] Ratings prescribed by CBFC <https://cbfcindia.gov.in/cbfcAdmin/>

Acknowledgments

I would like to express my heartfelt gratitude to my family for inspiring this work. Whenever we watched TV together and encountered inappropriate content, it created a sense of discomfort for all of us. Their suggestion that advancements in video delivery technology should enable us to choose and watch only appropriate content, rather than feeling uncomfortable or needing to manually skip scenes served as the foundation of my motivation. This encouragement led me to develop a standard and mechanism for content personalization, aimed at catering to diverse viewer categories while respecting the interests of platforms, creators, audiences of all age groups, and regulatory authorities.

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