Getting Started
Widevine DRM on Devices

version 1.5

Contents

Version	Date	Description	By
0.1	12/16/2016	Initial draft	Alex Lee
0.2	1/17/2017	Added workflow diagram	Alex Lee
0.3	1/19/2017	Separated workflow diagrams	Alex Lee
1.0	2/21/2017	Updated current CDM Source version Added Android build and test information	Alex Lee
1.1	2/22/2017	Added Level1 Device Provisioning Models reference	Alex Lee
1.2	6/23/2017	Clarified GMS and CTS processes.	Alex Lee
1.3	6/30/2017	Expanded Widevine Device Security Levels section.	Alex Lee
1.4	11/28/2017	Updated integration workflow diagrams.	Alex Lee
1.5	1/28/2018	Added oemcrypto repository.	Alex Lee

Summary

This document outlines the process, documentation and options to **integrate the Widevine DRM client** into a **device or chipset platform**.

The target audience for this document are:
- Device manufacturers
- Chipset vendors

If you are interested in the full Widevine ecosystem, please see the [Getting Started guide for content partners](#).

Contact Us

For all questions, please [contact Widevine](#) from our website - [www.widevine.com](#).

For device integration issues, select *I'm a hardware manufacturer or partner* and then select *Other*.
For other inquiries, select *I have a general inquiry*.

Introduction

Widevine DRM is Google's content protection system for premium media. It is used by major partners around the world such as Google Play, YouTube, Google Fiber, Netflix, Hulu, Amazon and much more. The focus of Widevine is to provide the best experience for viewing premium content over a digital distribution method.

A license agreement is required for the use of Widevine products or services. **Widevine does not assess any license fees for use of its products and services.**

Our [architecture overview](#) provides a comprehensive description of the technologies and standards used.

The Widevine client is embedded into a device platform unless otherwise noted.

Device or Platform	Supported ?
Android 4.0 Ice Cream Sandwich	-
Android 4.1 and 4.2 Jellybean	-

Android 4.3 Jellybean MR2	Yes [2]
Android 4.4, 5.x, 6.x and 7.x	Yes
Android TV	Yes
Apple iOS	Yes [1]
Apple TV (tvOS)	-
Chrome browser	Yes
ChromeOS (Chromebook)	Yes
Chromecast	Yes
Chromium browser	Yes
Chromium Embedded Framework (CEF), Electron	Yes
Firefox browser	Yes
Internet Explorer browser	-
Opera (browser and embedded devices)	Yes
Roku	Yes
Safari browser (desktop)	-
Sony Playstation	Yes [1]
TV sets and Blu-ray players	Yes
Xbox	-

[1] *Available as a separate client library*

[2] *On selected devices only*

Ecosystem
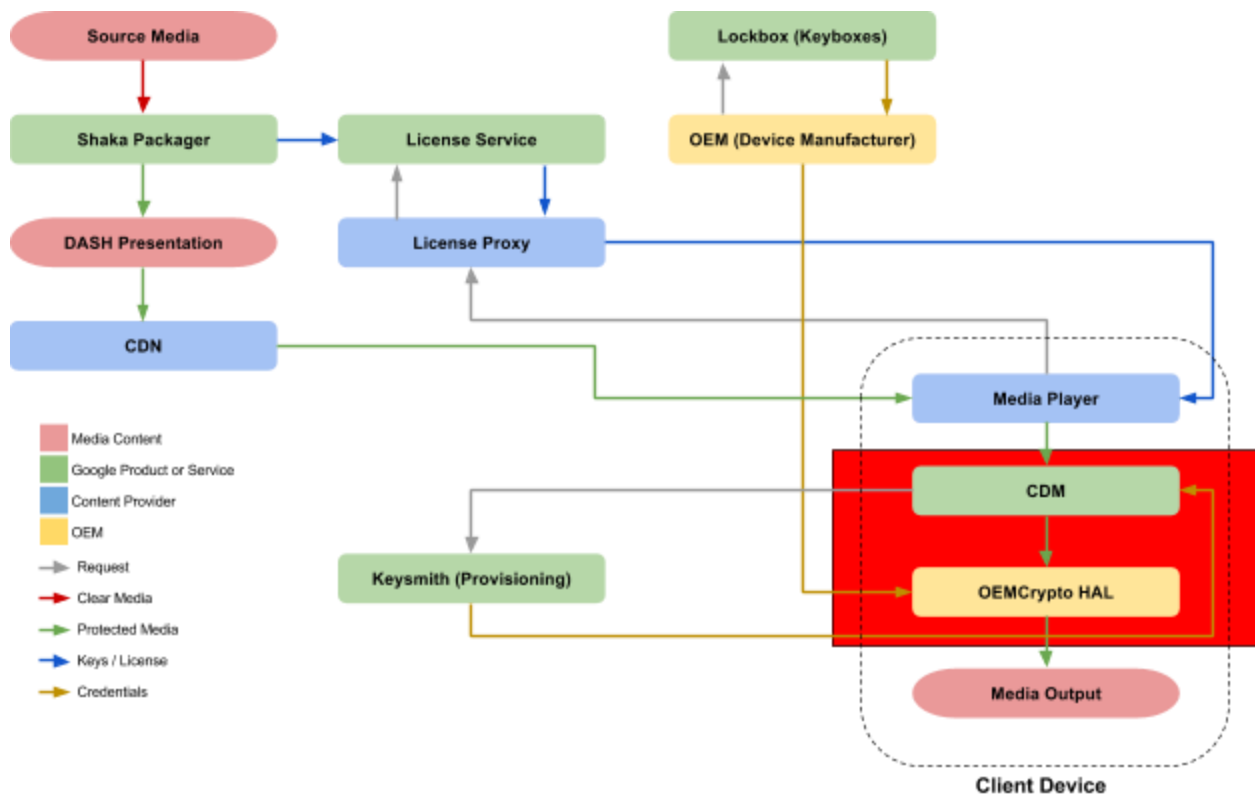
The diagram above illustrates the Widevine components within the DRM ecosystem.
This document is focused on the area outlined in **red**.

Briefly, a standard Widevine device integration requires:
- An implementation of OEMCrypto that complies with a specific Widevine Device Security Level.
  - Building the Widevine CDM Source with OEMCrypto.
- Obtain Widevine keyboxes for Widevine Level 1 implementations.
  - See Device Provisioning Models for more information about Widevine device provisioning.
  - See Getting Started with Device Management to request keyboxes.
- Register your device within the Widevine system (e.g. Make, Model)
  - See Getting Started with Device Management.
  - When an integration is in progress, a device entry is initially marked as FOR_TESTING.
  - When integration is complete, a device entry is marked as RELEASED to allow production use.

Workflow - Android and Android TV Integration
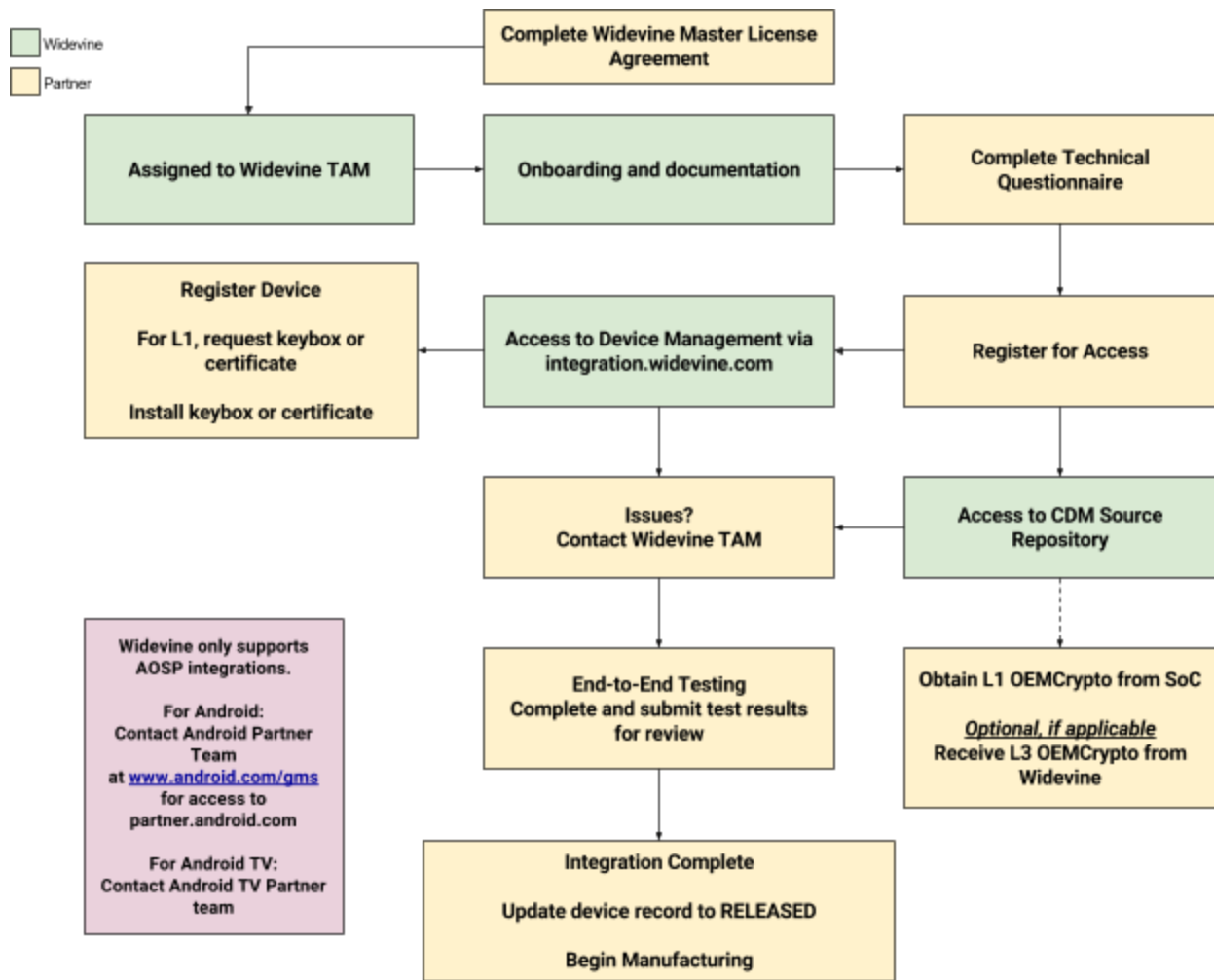
For devices that will ship with Google Apps (GMS), you will need to contact the Android Partner team via www.android.com/gms. It includes Widevine as part of the integration and certification process. Response times for GMS integrations may vary and is beyond Widevine's control.

Widevine directly support Android integrations using AOSP. It is highly recommended to ensure that your AOSP integration is validated using the Compatibility Test Suite (CTS). Device testing for Widevine can be accomplished by using the ExoPlayer demo application which contain a list of Widevine test cases.

L1 OEMCrypto libraries are provided by the SoC vendor for the Android device.

End-to-end tests to be executed is provided by Widevine.

Access to the device and keybox management interface at integration.widevine.com is described in the Getting Started with Device Management document. Registering the device make and model is equivalent to `product.ro.manufacturer` and `product.ro.model`.

Workflow - Device Integration (TV, Bluray, STB, Embedded Linux)
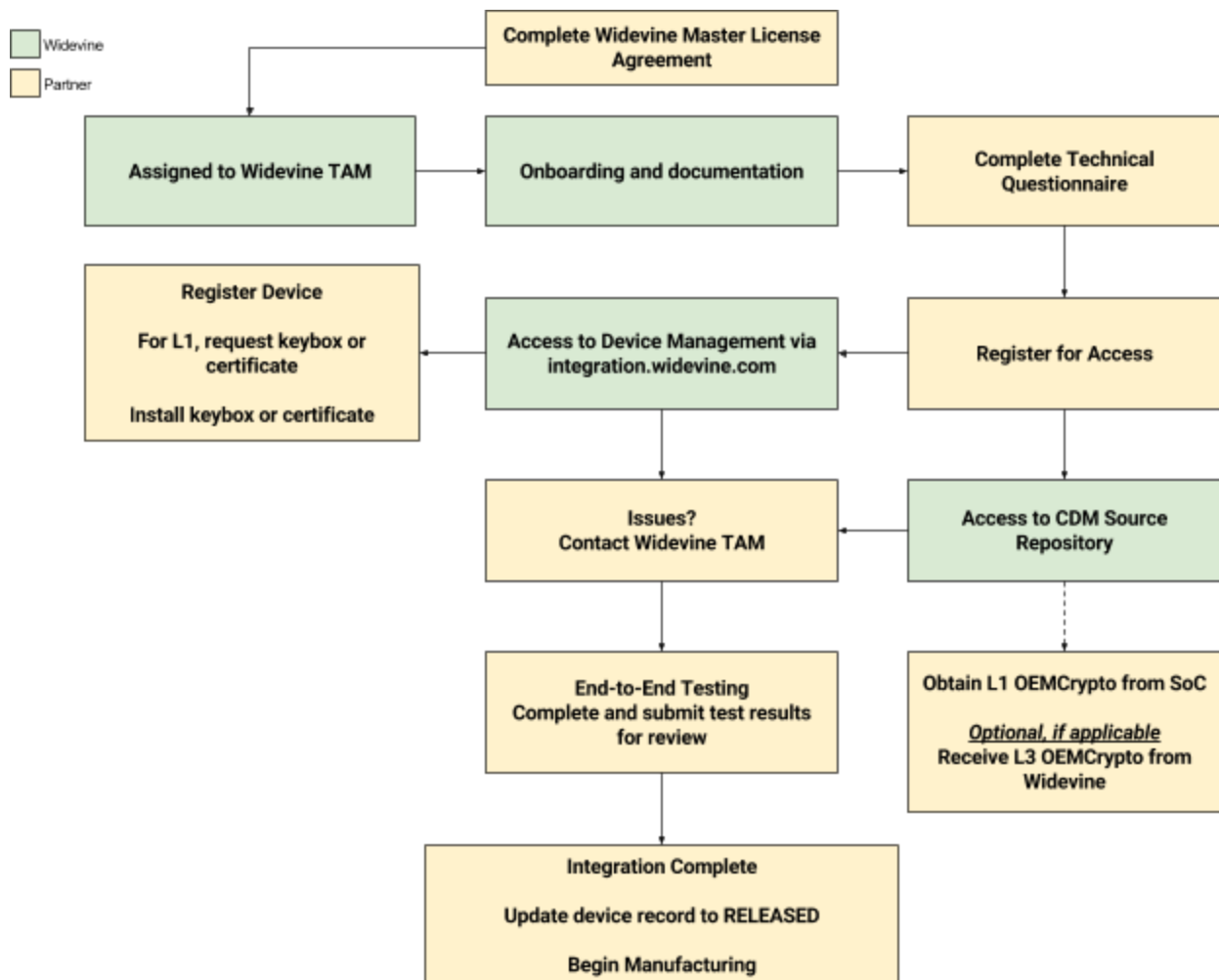
This category of Widevine client integration covers a wide variety of device platforms, across a multitude of operating systems. As such, these consumer electronic (CE) device integrations require additional consultation with the Widevine team to determine the best path forward.

L1 OEMCrypto libraries are provided by the SoC vendor.
L3 OEMCrypto libraries are provided by Widevine.

If you are unsure or have questions regarding OEMCrypto or have a different device design, please contact us.

Access to the device and keybox management interface at integration.widevine.com is described in the Getting Started with Device Management document.

For validation, Widevine test content urls, both clear and encrypted versions of the same files, are available at the end of this document.

Accessing the Widevine Partner Repository

The Widevine CDM client is available via a Widevine-managed code repository, per platform.

The [Accessing the Widevine Repository guide](#) provides information on how to register for access to the appropriate repository.

CDM Source

The current version of CDM Source (and its associated OEMCrypto pairing)
- CDM Source version 3.5.0
  - OEMCrypto version 13

Please [contact us](#) to confirm use of earlier software versions.

OEMCrypto

The current version of OEMCrypto is 14.
This repository is for chipset and platform vendors to maintain and update their OEMCrypto implementations.

iOS

Information about how to integrate the iOS client is located within each release branch.

Android

Required

The Widevine CDM is located under `<branch>/libwvdrmengine`
CDM documentation is located under `<branch>/libwvdrmengine/docs`

The Widevine CDM is required for encrypted (CENC) DASH compatibility. This is required from Android 4.4 onwards.

Branch	Android Version	OEMCrypto Version
klp	Android 4.4.x	OEMCrypto 8

lmp	Android 5.x	OEMCrypto 9
mnc	Android 6.x	OEMCrypto 10
nyc	Android 7.x	OEMCrypto 11
oc	Android 8.0	OEMCrypto 11
oc-mr1	Android 8.1	OEMCrypto 11 for upgrades OEMCrypto 13 for new devices

Building

To build, place the widevine repo at `ROOT/vendor/widevine` in the AOSP tree where `ROOT` is the root of the AOSP tree. The build scripts for Android will automatically detect and build the Widevine CDM. For more information on building Android, see the documentation on building the AOSP project.

Testing

After building, to test the Widevine CDM, run "`sh build_and_run_all_unit_tests.sh`" located in `WIDEVINE_ROOT/libwvdrmengine/`.

Validation

It is recommended that your AOSP device complete CTS (Compatibility Test Suite). However, CTS does not contain any Widevine-specific tests.

To exercise and validate Widevine compatibility, install the latest ExoPlayer v2 demo APK.
- **REQUIRED** - Successfully execute all items under *Widevine DASH Policy Tests (GTS)*
- **RECOMMENDED** - Successfully execute all items under *Widevine HDCP Capabilities Tests* (HDMI connection required)
- OPTIONAL - These tests are sanity checks for format and codec support.
    - *Widevine DASH: MP4 H264*
    - *Widevine DASH: WebM VP9*
    - *Widevine DASH: MP4 H265*

Widevine Client Security Levels

The following security level definitions are used by Widevine:

Security Level 1 (L1)

Widevine DRM keys and decrypted content are never exposed to the host CPU. Only security hardware or a protected security co-processor uses clear key values and the media content is decrypted by the secure hardware.

Key requirements of this security level:
- Device manufacturers must provide a secure bootloader. The chain of trust from the bootloader must extend through any software or firmware components involved in the security implementation, such as the ARM TrustZone protected application and any components involved in the enforcement of the secure video path.
- The Widevine keybox must be encrypted with a device-unique secret key that is not visible to software or probing methods outside of the TrustZone. The Widevine key-box must be installed in the factory or delivered to the device using an approved secure delivery mechanism.
- Device manufacturers must provide an implementation of the Widevine Level 1 OEMCrypto API that performs all key processing and decryption in a trusted environment.

All content processing, cryptography, and control is performed within the Trusted Execution Environment (TEE). In some implementation models, security processing may be performed in different chips.

This level of security requires factory provisioning of the Widevine keybox or requires the Widevine keybox to be protected by a device key installed at the time of manufacturing.

The Device Provisioning Models document provides additional information about Widevine device provisioning models.

This is the recommended path for any device integration as it provides the highest level of security.

Security Level 2 (L2)

The Widevine keys are never exposed to the host CPU. Only security hardware or a protected security co-processor uses clear key values. An AES crypto block performs the high throughput AES decryption of the media stream. The resulting clear media buffers are returned to the CPU for delivery to the video decoder.

Performs cryptography (but not video processing) within the TEE: decrypted buffers are returned to the application domain and processed through separate video hardware or software. At level 2, however, cryptographic information is still processed only within the trusted execution environment.

This level of security requires factory provisioning of the Widevine keybox or requires the Widevine keybox to be protected by a keybox installed at the time of manufacturing.

Key requirements of this security level:
- Device manufacturers must provide a secure bootloader. The chain of trust from the bootloader must extend through any software or firmware components involved in the security implementation, such as the TrustZone protected application.
- The Widevine keybox must be encrypted with a device-unique secret key that is not visible to software or probing methods outside of the TrustZone.
- The Widevine keybox must be installed in the factory or delivered to the device using an approved secure delivery mechanism.
- Device manufacturers must provide an implementation of the Widevine Level 2 OEMCrypto API that performs all key processing and decryption in a trusted environment.
- Device manufacturers must provide a bootloader that loads signed system images only.

For devices that allow users to load a custom operating system or gain root privileges on the device by unlocking the bootloader, device manufacturers must support the following:
- Device manufacturers must provide a bootloader that allows a Widevine keybox to be written only when the bootloader is in a locked state.
- The Widevine keybox must be stored in a region of memory that is erased or is inaccessible when the device bootloader is in an unlocked state.

Security Level 3 (L3)

This security level relies on the secure bootloader to verify the system image. An AES crypto block performs the AES decryption of the media stream and the resulting clear media buffers are returned to the CPU for delivery to the video decoder.

Does not have a TEE on the device. Appropriate measures may be taken to protect the cryptographic information and decrypted content on host operating system. A Level 3 implementation may also include a hardware cryptographic engine, but that only enhances performance, not security.

Device manufacturers must provide a bootloader that loads signed system images only. For devices that allow users to load a custom operating system or gain root privileges on the device by unlocking the bootloader, device manufacturers must support the following:

- Device manufacturers must provide a bootloader that allows a Widevine keybox to be written only when the bootloader is in a locked state.
- The Widevine keybox must be stored in a region of memory that is erased or is inaccessible when the device bootloader is in an unlocked state.

This categorization generally applies to software-only client solutions.

Sample Test Content

The tables below provide sample test content in a variety of codecs and resolutions, both clear and encrypted.

For encrypted content, the license URL is **https://proxy.uat.widevine.com/proxy**
- Playback of encrypted content will stop at 10 seconds if a license is not delivered to the device.

H264

Content Type	Frames per second	Clear	Encrypted
SD and HD	24fps	https://storage.googleapis.com/wvmedia/clear/h264/tears/tears.mpd	https://storage.googleapis.com/wvmedia/cenc/h264/tears/tears.mpd
SD 240p 800kbps 480p 2mbps	24fps	https://storage.googleapis.com/wvmedia/clear/h264/tears/tears_sd.mpd	https://storage.googleapis.com/wvmedia/cenc/h264/tears/tears_sd.mpd
HD 720p 8mbps 1080p 20mbps	24fps	https://storage.googleapis.com/wvmedia/clear/h264/tears/tears_hd.mpd	https://storage.googleapis.com/wvmedia/cenc/h264/tears/tears_hd.mpd
SD and HD	30fps	https://storage.googleapis.com/wvmedia/clear/h264/30fps/tears/tears.mpd	https://storage.googleapis.com/wvmedia/cenc/h264/30fps/tears/tears.mpd
SD 240p 800kbps 480p 2mbps	30fps	https://storage.googleapis.com/wvmedia/clear/h264/30fps/tears/tears_sd.mpd	https://storage.googleapis.com/wvmedia/cenc/h264/30fps/tears/tears_sd.mpd
HD 720p 8mbps 1080p 20mbps	30fps	https://storage.googleapis.com/wvmedia/clear/h264/30fps/tears/tears_hd.mpd	https://storage.googleapis.com/wvmedia/cenc/h264/30fps/tears/tears_hd.mpd

SD and HD	60fps	https://storage.googleapis.com/wvmedia/clear/h264/60fps/tears/tears.mpd	https://storage.googleapis.com/wvmedia/cenc/h264/60fps/tears/tears.mpd
SD 240p 800kbps 480p 2mbps	60fps	https://storage.googleapis.com/wvmedia/clear/h264/60fps/tears/tears_sd.mpd	https://storage.googleapis.com/wvmedia/cenc/h264/60fps/tears/tears_sd.mpd
HD 720p 8mbps 1080p 20mbps	60fps	https://storage.googleapis.com/wvmedia/clear/h264/60fps/tears/tears_hd.mpd	https://storage.googleapis.com/wvmedia/cenc/h264/60fps/tears/tears_hd.mpd

HEVC

Content Type	Frames per second	Clear	Encrypted
SD and HD	24fps	https://storageapis.com/wvmedia/clear/hevc/tears/tears.mpd	https://storageapis.com/wvmedia/cenc/hevc/tears/tears.mpd
SD 240p 600kbps 360p 1600kbps 480p 3mbps	24fps	https://storageapis.com/wvmedia/clear/hevc/tears/tears_sd.mpd	https://storageapis.com/wvmedia/cenc/hevc/tears/tears_sd.mpd
HD 720p 4mbps 1080p 10mbps	24fps	https://storageapis.com/wvmedia/clear/hevc/tears/tears_hd.mpd	https://storageapis.com/wvmedia/cenc/hevc/tears/tears_hd.mpd
UHD 2160p 20mbps	24fps	https://storageapis.com/wvmedia/clear/hevc/tears/tears_uhd.mpd	https://storageapis.com/wvmedia/cenc/hevc/tears/tears_uhd.mpd
SD and HD	30fps	https://storageapis.com/wvmedia/clear/hevc/30fps/tears/tears.mpd	https://storageapis.com/wvmedia/cenc/hevc/30fps/tears/tears.mpd
SD 240p 600kbps 360p 1600kbps 480p 3mbps	30fps	https://storageapis.com/wvmedia/clear/hevc/30fps/tears/tears_sd.mpd	https://storageapis.com/wvmedia/cenc/hevc/30fps/tears/tears_sd.mpd
HD 720p 4mbps 1080p 10mbps	30fps	https://storageapis.com/wvmedia/clear/hevc/30fps/tears/tears_hd.mpd	https://storageapis.com/wvmedia/cenc/hevc/30fps/tears/tears_hd.mpd
UHD 2160p 20mbps	30fps	https://storageapis.com/wvmedia/clear/hevc/30fps/tears/tears_uhd.mpd	https://storageapis.com/wvmedia/cenc/hevc/30fps/tears/tears_uhd.mpd

SD and HD	60fps	https://storage.googleapis.com/wvmedia/clear/hevc/60fps/tears/tears.mpd	https://storage.googleapis.com/wvmedia/cenc/hevc/60fps/tears/tears.mpd
SD 240p 600kbps 360p 1600kbps 480p 3mbps	60fps	https://storage.googleapis.com/wvmedia/clear/hevc/60fps/tears/tears_sd.mpd	https://storage.googleapis.com/wvmedia/cenc/hevc/60fps/tears/tears_sd.mpd
HD 720p 4mbps 1080p 10mbps	60fps	https://storage.googleapis.com/wvmedia/clear/hevc/60fps/tears/tears_hd.mpd	https://storage.googleapis.com/wvmedia/cenc/hevc/60fps/tears/tears_hd.mpd
UHD 2160p 20mbps	60fps	https://storage.googleapis.com/wvmedia/clear/hevc/60fps/tears/tears_uhd.mpd	https://storage.googleapis.com/wvmedia/cenc/hevc/60fps/tears/tears_uhd.mpd

VP9

Content Type	Frames per second	Clear	Encrypted
SD and HD	24fps	https://storage.googleapis.com/wvmedia/clear/vp9/tears/tears.mpd	https://storage.googleapis.com/wvmedia/cenc/vp9/tears/tears.mpd
SD 240p 600kbps 360p 1600kbps	24fps	https://storage.googleapis.com/wvmedia/clear/vp9/tears/tears_sd.mpd	https://storage.googleapis.com/wvmedia/cenc/vp9/tears/tears_sd.mpd
HD 720p 4mbps 1080p 5mbps	24fps	https://storage.googleapis.com/wvmedia/clear/vp9/tears/tears_hd.mpd	https://storage.googleapis.com/wvmedia/cenc/vp9/tears/tears_hd.mpd
UHD 2160p 20mbps	24fps	https://storage.googleapis.com/wvmedia/clear/vp9/tears/tears_uhd.mpd	https://storage.googleapis.com/wvmedia/cenc/vp9/tears/tears_uhd.mpd
SD and HD	30fps	https://storage.googleapis.com/wvmedia/clear/vp9/30fps/tears/tears.mpd	https://storage.googleapis.com/wvmedia/cenc/vp9/30fps/tears/tears.mpd
SD 240p 600kbps 360p 1600kbps	30fps	https://storage.googleapis.com/wvmedia/clear/vp9/30fps/tears/tears_sd.mpd	https://storage.googleapis.com/wvmedia/cenc/vp9/30fps/tears/tears_sd.mpd
HD 720p 4mbps 1080p 5mbps	30fps	https://storage.googleapis.com/wvmedia/clear/vp9/30fps/tears/tears_hd.mpd	https://storage.googleapis.com/wvmedia/cenc/vp9/30fps/tears/tears_hd.mpd
UHD 2160p 20mbps	30fps	https://storage.googleapis.com/wvmedia/clear/vp9/30fps/tears/tears_uhd.mpd	https://storage.googleapis.com/wvmedia/cenc/vp9/30fps/tears/tears_uhd.mpd
SD and HD	60fps	https://storage.googl	https://storage.googl

		eapis.com/wvmedia/clear/vp9/60fps/tears/tears.mpd	eapis.com/wvmedia/cenc/vp9/60fps/tears/tears.mpd
SD 240p 600kbps 360p 1600kbps	60fps	https://storage.googleapis.com/wvmedia/clear/vp9/60fps/tears/tears_sd.mpd	https://storage.googleapis.com/wvmedia/cenc/vp9/60fps/tears/tears_sd.mpd
HD 720p 4mbps 1080p 5mbps	60fps	https://storage.googleapis.com/wvmedia/clear/vp9/60fps/tears/tears_hd.mpd	https://storage.googleapis.com/wvmedia/cenc/vp9/60fps/tears/tears_hd.mpd
UHD 2160p 20mbps	60fps	https://storage.googleapis.com/wvmedia/clear/vp9/60fps/tears/tears_uhd.mpd	https://storage.googleapis.com/wvmedia/cenc/vp9/60fps/tears/tears_uhd.mpd