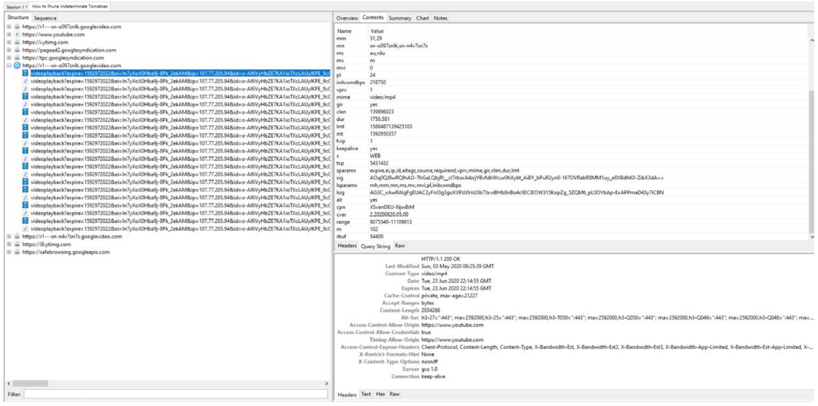
Claim Language	Contention
Overview	WAG has asserted three patents against YouTube LLC and/or affiliated entities such as Google LLC ("YouTube"), which concern streaming media over the Internet, conducted between a user (client) system, which requests and plays the media, and a server to which the client system connects over the Internet, which provides the requested media. WAG's '824 patent (the subject of the within contentions) concerns methods, apparatus, and computer program products on the server side of this interaction, for prerecorded media. WAG's '594 patent concerns methods, apparatus, and computer program products on the client side of the above-described interaction. WAG's '636 patent corresponds to the '824 patent in certain respects, but concerns live media (*e.g.*, live performances) created contemporaneously with its streaming. Because the subject matter of these patents overlap, WAG's infringement contentions with regard to the '594 and '636 patents are each incorporated herein by reference. YouTube directs and controls the activity of streaming digitally encoded media it provides over the Internet through the site youtube.com (also accessible as www.youtube.com) (the "YouTube Web Site") from servers owned and/or the operations of which are controlled by YouTube, including servers in the U.S. and in the Western District of Texas ("YouTube's Servers"). These contentions relate to every streaming video program accessible from or through the YouTube Site for the period from the 2017 issuance dates of the patents addressed in these contentions, through the date of expiration (March 28, 2021). They further relate to videos streamed from YouTube's Servers (*e.g.*, googlevideo.com, tv.youtube.com) to embedded "YouTube" devices and apps. Also included in these contentions is streaming audio distribution from music.youtube.com (formerly Google Play Music), as well as the YouTube TV subscription service (available for distribution through tv.youtube.com). The foregoing services are addressed individually, but are also referred to, for purposes of collective reference, as the "YouTube Streaming Services." YouTube distributes pre-recorded video programs from YouTube's Servers, over the Internet, to large numbers of users in the U.S. and elsewhere. During the relevant period, this was done via a "pull" protocol (as further addressed below) defined at the application layer and generally conforming with the MPEG-DASH specification. (Google is a Charter Member of the DASH Industry Forum.) A protocol similar to MPEG-DASH is HTTP Live Streaming ("HLS"). HLS is a streaming media delivery specification, currently published as IETF RFC 8216. This claim chart is based on evidence observed in the course of YouTube's streaming. This claim chart alleges infringement based on such observations, without depending on whether YouTube fully complied with the MPEG-DASH or HLS standards in performing such streaming. However, WAG also asserts that the fact of compliance with either of those standards in itself separately supports all claim limitations and the conclusion of infringement. WAG has separately charted infringement of the

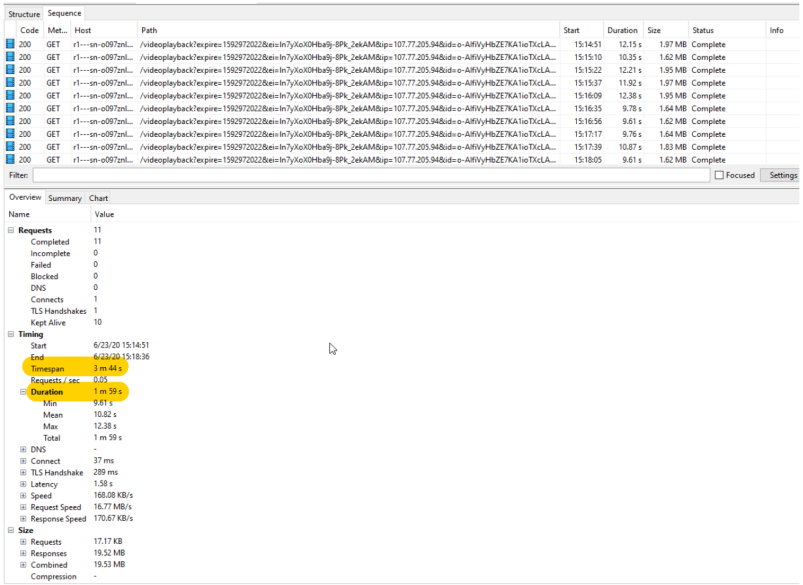
Claim Language	Contention
	’824, ’594, and ’636 patents that results from complying with the MPEG-DASH and HLS standards, and incorporates those charts herein by reference. The evidence herein is consistent with full compliance by YouTube with the MPEG-DASH standard from 2017-2021, and WAG believes YouTube fully complied with that standard during such period. WAG intends to further investigate YouTube’s compliance with the MPEG-DASH standard in discovery. WAG also has specific evidence of use of HLS by YouTube for certain live streams (see ’636 claim chart), but currently has no direct evidence of HLS having been used by YouTube from 2017-2021 for pre-recorded media. WAG has been impeded from investigating such usage in part by the fact that YouTube streams are often encrypted. However, there is evidence that YouTube has streamed with HLS beyond the specific types of sessions currently documented in these claim charts. For example, YouTube’s web pages (including those for pre-recorded media) also contain reference to a manifest for HLS, in addition to providing a link to an MPEG-DASH manifest. The client-side JavaScript files that YouTube distributes in support of its streaming media (*e.g.*, base.js) also provide functions for HLS. YouTube web pages also provide links to HLS manifests (as well as MPEG-DASH manifests). HLS use by YouTube is further reflected in YouTube’s technical support pages, *e.g.*, https://support.google.com/youtube/answer/2853702?hl=en&ref_topic=2853712 and https://support.google.com/youtube/answer/10349430. WAG contends that YouTube has supported streaming media delivery of pre-recorded programs during the relevant period via HLS as at least a fallback where the user device identifies itself as a device that normally will not support MPEG-DASH or prefers HLS. WAG intends to pursue discovery to investigate the foregoing and update these contentions as necessary. For distributing streaming media, YouTube has used its own Google Cloud Content Delivery Network (“CDN”) (which includes edge servers known as Google Global Cache (“GGC”) servers at locations including Midland, El Paso, Austin, and San Antonio, Texas), and also partnered with third-party providers, including without limitation Fastly, Cloudflare, Highwinds, Level 3, and Akamai, for CDN distribution. With regard to the infringement specifically documented herein, the pull protocol employed by YouTube is based on HTTP (or HTTPS) requests, which can be responded to through CDN servers at the network Edge that support HTTP/HTTPS retrieval (which most ordinary web servers are able to utilize), provided the edge server possesses the relevant media data elements. The same streaming mechanisms appear to be consistently supported through each CDN, independent of the type of user-agent on the client side, and in a similar manner over the respective CDNs. The first example shown below, from June 2020, is for a client-side device comprising a Chrome browser on a desktop computer. Insofar as relevant to meeting the limitations below, the evidence is the same in all material respects for all widely used browsers and devices (Chrome, Firefox, Internet Explorer, Edge, Safari, etc.),

Claim Language	Contention
	iOS, iPadOS, Android, FireOS, FireTV, Roku, TVOS and other “Smart TV” user systems, regardless of the CDN. Data herein such as the following, was observed through a web debugging proxy inserted in the communication path between a user system accessing a YouTube prerecorded video, and the YouTube Server (at a server in the domain googlevideo.com). The proxy provided is solely for data acquisition and testing purposes and is not in any way necessary to use YouTube’s Streaming Services, nor does it change any of the requests or responses while viewing video.) In addition, some of the data herein was acquired directly in a browser while watching various YouTube streams, using the “developer tools” and like utility functions built into the browser, for example, by hitting Ctrl-Shift-I and looking at the Network tab during playback. The same request-response patterns observed through a debugging proxy may also be readily observed using such developer tools built into the browser, on desktop and other non-embedded platforms that support full-featured browsers. The following is a representative example of the requests and responses observed (in this sample, taken in June 2020 using a proxy) in streaming a prerecorded video program from YouTube:  Session 1 How to Prune Indeterminate Tomatoes Structure Sequence https://r1---sn-o097znlk.googlevideo.com https://www.youtube.com https://i.ytimg.com https://pagead2.googlesyndication.com https://tpc.googlesyndication.com https://r1---sn-o097znlk.googlevideo.com videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AIfiVyHbZE7KA1ioTXcLAUyIKPE_9cC videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AIfiVyHbZE7KA1ioTXcLAUyIKPE_9cC videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AIfiVyHbZE7KA1ioTXcLAUyIKPE_9cC videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AIfiVyHbZE7KA1ioTXcLAUyIKPE_9cC videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AIfiVyHbZE7KA1ioTXcLAUyIKPE_9cC videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AIfiVyHbZE7KA1ioTXcLAUyIKPE_9cC videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AIfiVyHbZE7KA1ioTXcLAUyIKPE_9cC videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AIfiVyHbZE7KA1ioTXcLAUyIKPE_9cC videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AIfiVyHbZE7KA1ioTXcLAUyIKPE_9cC videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AIfiVyHbZE7KA1ioTXcLAUyIKPE_9cC videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AIfiVyHbZE7KA1ioTXcLAUyIKPE_9cC videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AIfiVyHbZE7KA1ioTXcLAUyIKPE_9cC videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AIfiVyHbZE7KA1ioTXcLAUyIKPE_9cC videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AIfiVyHbZE7KA1ioTXcLAUyIKPE_9cC videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AIfiVyHbZE7KA1ioTXcLAUyIKPE_9cC videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AIfiVyHbZE7KA1ioTXcLAUyIKPE_9cC videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AIfiVyHbZE7KA1ioTXcLAUyIKPE_9cC videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AIfiVyHbZE7KA1ioTXcLAUyIKPE_9cC videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AIfiVyHbZE7KA1ioTXcLAUyIKPE_9cC videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AIfiVyHbZE7KA1ioTXcLAUyIKPE_9cC videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AIfiVyHbZE7KA1ioTXcLAUyIKPE_9cC https://r1---sn-n4v7sn7s.googlevideo.com https://i9.ytimg.com https://safebrowsing.googleapis.com Overview Contents Summary Chart Notes Name Value mm 31,29 mn sn-o097znlk,sn-n4v7sn7s ms au,rdu mv m mvi 0 pl 24 initcwndbps 218750 vprv 1 mime video/mp4 gir yes clen 139896023 dur 1750.381 lmt 1588487139425103 mt 1592950357 fvip 1 keepalive yes c WEB txp 5431432 sparams expire,ei,ip,id,aitags,source,requiressl,vprv,mime,gir,clen,dur,lmt sig AOq0QJ8wRQIhAO-ThGaLQbjRI__cl7rbsxA4zrjYBvfdkWcur0hXybt_AiBY_bPuR2yn9-167OVRabR8MM1uy_e8XBdhK0-ZibX3dA== lsparams mh,mm,mn,ms,mv,mvi,pl,initcwndbps lsig AG3C_xAwRAIgFgEUAC2yFnJ3g3guVXPzUVsU3b73xviBHb8nBo4cIIECIEOW315KopZg_5ZQM6_pL0OYbAp-ExAPPmaD43y7iCBN alr yes cpn XSvenDEU-NjwBihf cver 2.20200620.05.00 range 9075548-11109813 rn 102 rbuf 54409 Headers Query String Raw HTTP/1.1 200 OK Last-Modified Sun, 03 May 2020 06:25:39 GMT Content-Type video/mp4 Date Tue, 23 Jun 2020 22:14:55 GMT Expires Tue, 23 Jun 2020 22:14:55 GMT Cache-Control private, max-age=21227 Accept-Ranges bytes Content-Length 2034266 Alt-Svc h3-27=":443"; ma=2592000,h3-25=":443"; ma=2592000,h3-T050=":443"; ma=2592000,h3-Q050=":443"; ma=2592000,h3-Q049=":443"; ma=2592000,h3-Q048=":443"; ma=... Access-Control-Allow-Origin https://www.youtube.com Access-Control-Allow-Credentials true Timing-Allow-Origin https://www.youtube.com Access-Control-Expose-Headers Client-Protocol, Content-Length, Content-Type, X-Bandwidth-Est, X-Bandwidth-Est2, X-Bandwidth-Est3, X-Bandwidth-App-Limited, X-Bandwidth-Est-App-Limited, X-... X-Restrict-Formats-Hint None X-Content-Type-Options nosniff Server gvs 1.0 Connection keep-alive Headers Text Hex Raw The entirety of each requested video program (from beginning to end) is delivered as a series of time-sequenced media data elements, where each such element has been given one or more serial identifiers (*e.g.*, range=9075548-11109813, rn=102), and requested by serial identifier, as reflected by the sample sequence above, reflecting 11 such successive requests, interleaved with similarly sequenced requests for the audio portion of the program. The client-side software in these examples is responsible for requesting each such element, by its serial identifier, when and as needed by the client, in order to sustain continuous and uninterrupted playback. The overall process is sometimes referred to as a “pull,” in that the streaming media flow as to each element in the stream depends on specific client-side requests for the respective elements comprising the

Claim Language | **Contention**

stream. Within the limits of the ability of the server and the communication channel to serve requested elements, the pacing of streaming delivery is controlled by the client.

In order for the client's pacing of content requests to be effective, and for playback of the stream on the client to continue without interruption, it should not take longer to request and receive the individual segments than the time it takes to play the segments back at a normal rendition. Repeated observations confirm that transmissions from YouTube Servers consistently meet these requirements. For example, in the below sequence, requesting and receiving video data having 3m 44 sec of playback time only uses 1m 59sec. for the transfer, meaning that the data is transferred in about half the time it takes for the client system to play it back:



Structure | Sequence

Code	Met...	Host	Path	Start	Duration	Size	Status	Info
200	GET	r1---sn-o097znl...	/videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AlfiVyHbZE7KA1ioTXcLA...	15:14:51	12.15 s	1.97 MB	Complete	
200	GET	r1---sn-o097znl...	/videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AlfiVyHbZE7KA1ioTXcLA...	15:15:10	10.35 s	1.62 MB	Complete	
200	GET	r1---sn-o097znl...	/videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AlfiVyHbZE7KA1ioTXcLA...	15:15:22	12.21 s	1.95 MB	Complete	
200	GET	r1---sn-o097znl...	/videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AlfiVyHbZE7KA1ioTXcLA...	15:15:37	11.92 s	1.97 MB	Complete	
200	GET	r1---sn-o097znl...	/videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AlfiVyHbZE7KA1ioTXcLA...	15:16:09	12.38 s	1.95 MB	Complete	
200	GET	r1---sn-o097znl...	/videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AlfiVyHbZE7KA1ioTXcLA...	15:16:35	9.78 s	1.64 MB	Complete	
200	GET	r1---sn-o097znl...	/videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AlfiVyHbZE7KA1ioTXcLA...	15:16:56	9.61 s	1.62 MB	Complete	
200	GET	r1---sn-o097znl...	/videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AlfiVyHbZE7KA1ioTXcLA...	15:17:17	9.76 s	1.64 MB	Complete	
200	GET	r1---sn-o097znl...	/videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AlfiVyHbZE7KA1ioTXcLA...	15:17:39	10.87 s	1.83 MB	Complete	
200	GET	r1---sn-o097znl...	/videoplayback?expire=1592972022&ei=In7yXoX0Hba9j-8Pk_2ekAM&ip=107.77.205.94&id=o-AlfiVyHbZE7KA1ioTXcLA...	15:18:05	9.61 s	1.62 MB	Complete	

Filter: □ Focused Settings

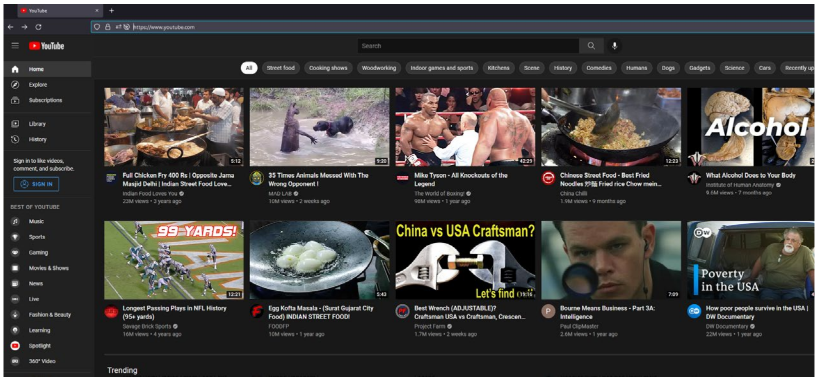
Overview | Summary | Chart

```
Name                 Value
⊟ Requests           11
    Completed        11
    Incomplete       0
    Failed           0
    Blocked          0
    DNS              0
    Connects         1
    TLS Handshakes   1
    Kept Alive       10
⊟ Timing
    Start            6/23/20 15:14:51
    End              6/23/20 15:18:36
    Timespan         3 m 44 s
    Requests / sec   0.05
  ⊟ Duration         1 m 59 s
      Min            9.61 s
      Mean           10.82 s
      Max            12.38 s
      Total          1 m 59 s
  ⊞ DNS              -
  ⊞ Connect          37 ms
  ⊞ TLS Handshake    289 ms
  ⊞ Latency          1.58 s
  ⊞ Speed            168.08 KB/s
  ⊞ Request Speed    16.77 MB/s
  ⊞ Response Speed   170.67 KB/s
⊟ Size
  ⊞ Requests         17.17 KB
  ⊞ Responses        19.52 MB
  ⊞ Combined         19.53 MB
    Compression      -
```

The MPEG-DASH standard, ISO/IEC 23009, spells out media distribution steps that align identically with each of the claim limitations herein. The version of the MPEG-DASH specification referenced herein is the Fourth edition, Dec. 2019. However, WAG believes that YouTube also complied with earlier and later versions of this standard, with no differences between such versions being material to the claims herein.

The foregoing figures are representative of every platform streaming from YouTube Servers for which WAG has been able to observe the contents of HTTP(S) traffic, including Chrome, Firefox, Safari, and other desktop browsers, iOS on iPhone and iPad, and Android, as well as TVOS and FireOS. It is also representative of Google Play Music/Youtube Music, except insofar as these audio services are limited to audio media data elements (still nevertheless internally named "videoplayback").

On some embedded platforms (such as Roku and TVOS), due to encryption, WAG has been unable to inspect the contents of HTTPS (encrypted) requests and responses.

Claim Language	Contention
	However, the timing of the encrypted requests and responses follow the same pattern as observable on other platforms (*e.g.*, desktop Chrome, as well as the FireOS embedded platform), and WAG believes the MPEG-DASH streaming implementation is the same in all material respects to the other observed implementations. WAG will include in its discovery requests inquiries directed to the additional platforms whose communications have been obscured by encryption.
[1.P.1] A method	This method is performed when prerecorded streaming video programming is distributed by YouTube's Servers to users in the U.S.
[1.P.2] for distributing over the Internet,	The YouTube Streaming Services are accessible over the Internet through the youtube.com/www.youtube.com website, as well as directly from YouTube Servers including googlevideo.com and tv.youtube.com. For example:  YouTube https://www.youtube.com Search All Street food Cooking shows Woodworking Indoor games and sports Kitchens Scene History Comedies Humans Dogs Gadgets Science Cars Recently up Home Explore Subscriptions Library History Sign in to like videos, comment, and subscribe. SIGN IN BEST OF YOUTUBE Music Sports Gaming Movies & Shows News Live Fashion & Beauty Learning Spotlight 360° Video Full Chicken Fry 400 Rs | Opposite Jama Masjid Delhi | Indian Street Food Love... Indian Food Loves You 23M views • 3 years ago 35 Times Animals Messed With The Wrong Opponent ! MAD LAB 10M views • 2 weeks ago Mike Tyson - All Knockouts of the Legend The World of Boxing! 98M views • 1 year ago Chinese Street Food - Best Fried Noodles 炒麵 Fried rice Chow mein... China Chilli 1.9M views • 9 months ago Alcohol What Alcohol Does to Your Body Institute of Human Anatomy 9.6M views • 7 months ago 99 YARDS! Longest Passing Plays in NFL History (95+ yards) Savage Brick Sports 16M views • 4 years ago Egg Kofta Masala - (Surat Gujarat City Food) INDIAN STREET FOOD! FOODFP 10M views • 1 year ago China vs USA Craftsman? Let's find Best Wrench (ADJUSTABLE)? Craftsman USA vs Craftsman, Crescen... Project Farm 1.7M views • 2 weeks ago Bourne Means Business - Part 3A: Intelligence Paul ClipMaster 2.6M views • 1 year ago Poverty in the USA How poor people survive in the USA | DW Documentary DW Documentary 22M views • 1 year ago Trending Activating a link on youtube.com/www.youtube.com (or similarly requesting a video through a Roku app or the like) results in a transmission of the streaming media over the Internet. For example, clicking on the "Full Chicken Fry" video results in transmission of that video program. Programming on YouTube ranges from short clips of under a minute to full-length movie, sports, news, and current events programs (among others), which can have durations of two or more hours. (YouTube live programming, addressed under separate contentions, can run continuously.)
[1.P.3] from a server system	YouTube's videos are distributed from servers accessible through youtube.com/www.youtube.com, or directly from servers such as googlevideo.com and tv.youtube.com:

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