

# **Session-Based DASH Streaming:**

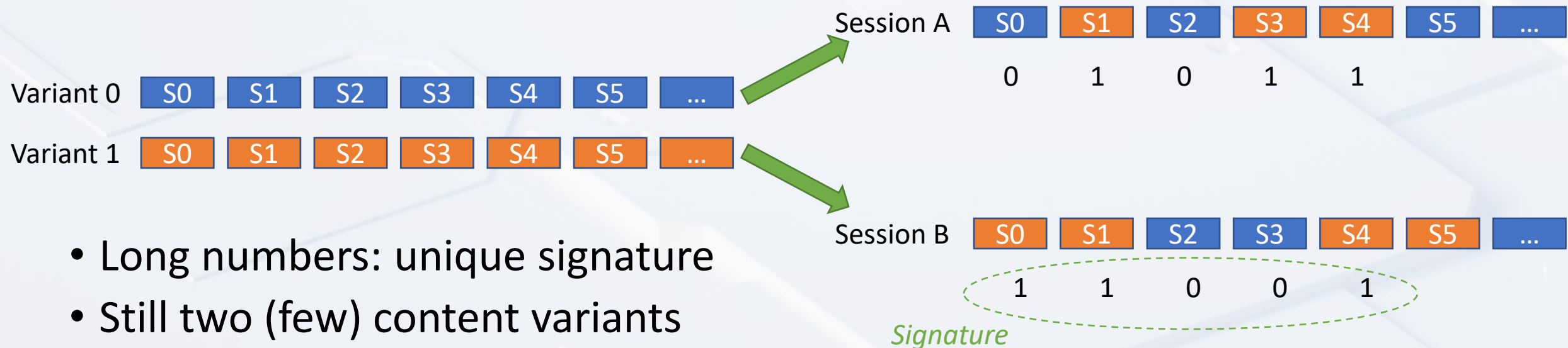
## ***A new MPEG standard for customizing DASH streaming***

Iraj Sodagar (Tencent)

Alex Giladi (Comcast)

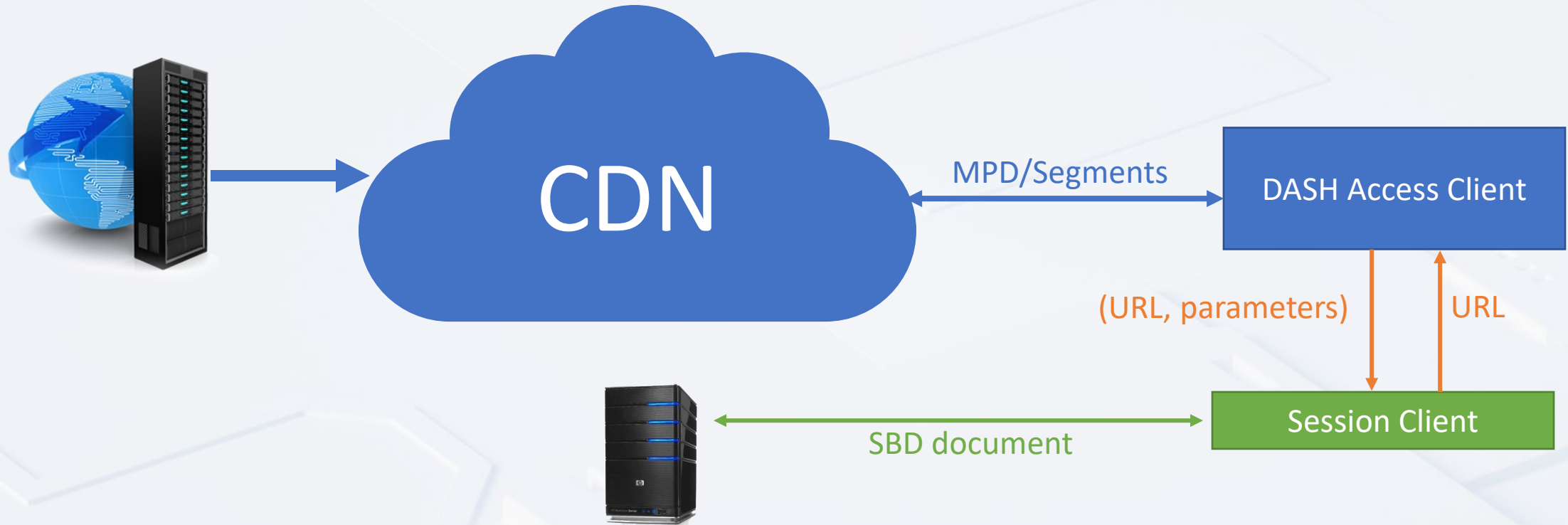
# Example use case: forensic watermarking

- Embedding imperceptible watermarks in media segment
- For identification of a particular viewing session
- Robust since embedded in media content
- Big differentiator: PER SESSION



- Long numbers: unique signature
- Still two (few) content variants

# Session Based DASH Streaming



- Customizing the requested URL by DASH Access Client based on the session-based document (SBD)

# Process example: Segment URL modification

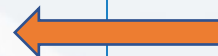
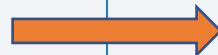
## DASH client:

- Receives an MPD
- Parse and creates a playback session
- ...
- ...
- ...
- Find the next segment URL to fetch (URL1)
- Fetches segment from URL2



## Session Based Client:

- Retrieve SBD URL from MPD
- Downloads SBD
- ...
- ...
- Get URL1 and parameters
- Find matches into the SBD table
- Generates a new URL2
- Pass URL2 to the DASH client



# SBD Operation: Time based key-value matching

Start time	$k_1$	$k_2$	...	$k_n$
$t_1$	$v_{1,1}$	$v_{1,2}$	...	$v_{1,n}$
$t_2$	$v_{2,1}$	$v_{2,2}$	...	$v_{2,n}$
...	...	...	...	...
$t_m$	$v_{m,1}$	$v_{m,2}$	...	$v_{m,n}$

In the above table  $t_i$  indicates the moment  $i$  in media timeline, and  $(k_i, v_{i,j})$  are the key-value pair  $j$  for time interval  $[t_i, t_{i+1})$ .

# SBD Operation: order based key-value matching

Start time	$k_1$	$k_2$	...	$k_n$
$n_1$	$v_{1,1}$	$v_{1,2}$	...	$v_{1,n}$
$n_2$	$v_{2,1}$	$v_{2,2}$	...	$v_{2,n}$
...	...	...	...	...
$n_m$	$v_{m,1}$	$v_{m,2}$	...	$v_{m,n}$

In the above table,  $n_i$  indicates segment  $i$  and  $(k_i, v_{i,j})$  are the key-value pair  $j$  for all segments from segment  $i$  to segment  $i + 1$ , but not including segment  $i + 1$ .

# Session based Characteristics

- Ability to manipulating various parts of the URL
  - Host, port, part, path and query `host:port/path?query`
- Ability to manipulating several URL classes
  - Media segments, MPD, Xlink, callback, chaining, fallback
- Flexible Manipulating
  - Template based manipulation as well as (query) addition
  - Order or time based
  - Static or dynamic tables, e.g. the SBD file can be updated
    - Minimum update period for a dynamic SBD
  - Address portion of media timeline: Start and duration
  - Possibility of looping

# Example

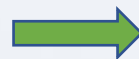
- MPD

```
<AdaptationSet
  mimeType="video/mp4" segmentAlignment="true" startWithSAP="1"
  maxWidth="1280" maxHeight="720" maxFrameRate="24000/1001" par="16:9">
  <EssentialProperty schemeIdUri="urn:mpeg:dash:sbd:2020"
    value="http://example.com/variant_sequence.json?client_id=ctulhu"
    xmlns:sbd="urn:mpeg:dash:sbd:2020"
    sbd:template="&parameter=$p1$"
    sbd:hostTemplate="$subdomain.$example.com" >
    <sbd:Key name="p1" defaultValue="nil"/>
    <sbd:Host name="subdomain." default=""/>
  </EssentialProperty>
  <SegmentTemplate duration="2" startNumber="1" media="
example.com/m1/video/$RepresentationID$_$Number%05d$.mp4">
  <Representation id="720p" codecs="avc3.4d401f" width="1280" height="720"
frameRate="24000/1001" sar="1:1" bandwidth="3000000"/>
  <Representation id="360p" codecs="avc3.4d401f" width="640" height="360"
frameRate="24000/1001" sar="1:1" bandwidth="1500000"/>
</AdaptationSet>
```

- SBD

```
{
  "KeyValue": [
    {
      "keylist": ["p1", "subdomain."],
      "comment": "A/B sequence document for user Ctulhu",
      "orderline": [
        {"v": ["861d34d7-56eb-4893-a7b7-60edabebe3e6", "s1."]},
        {"v": ["d8a56fd3-6c21-44be-94f8-a519cd6b4169", "s2."]},
        {"v": ["75b49311-008c-4272-9aff-b855ee94707a", "s3."]}
      ]
    }
  ]
}
```

```
http://example.com/m1/video/720p_00000.mp4
http://example.com/m1/video/720p_00001.mp4
http://example.com/m1/video/720p_00004.mp4
```



```
http://s1.example.com/m1/video/720p_00000.mp4?parameter=861d34d7-56eb-4893-a7b7-60edabebe3e6
http://s2.example.com/m1/video/720p_00001.mp4?parameter=d8a56fd3-6c21-44be-94f8-a519cd6b4169
http://s3.example.com/m1/video/720p_00004.mp4?parameter=75b49311-008c-4272-9aff-b855ee94707a
```



# Signaling in MPD (simplified)

Element or Attribute Name	Use	Description
EssentialProperty		
@schemeIdUri	M (string)	"urn:mpeg:dash:sbd:2020".
@value	M (string)	URL of the SBD document for this session
@template	O	template for applying to the key-value pair found in SBD document.  When the value of a Key@name in the @template is found in the SBD document, its corresponding key-value pair of SBD document shall replace the string between unescaped '\$' characters in the @template.
Key	1..N	a key name to be found in SBD document and its default value.
@name	M	Name of the key of the SBD document for adding the key=value pair
@defaultValue	OD ( 'null' )	default value in key-value pair if @name value not found in SBD document or if there is no value defined for a requested time range or segment number in the SBD document.

# SBD Structure (simplified)

Element	Description
<b>KeyValue</b>	provides information on a single key-value pair in the query string.
keylist	list of unique key names of key-value properties described in this element.
comment	a human-readable comment about this KeyValue
timescale	timescale in ticks per second for the @s and @d attributes. Default value is 1 (i.e., by default, v@d is in seconds).
type	possible values: "dynamic" , "static" "static": the SBD document and its values shall not change during the streaming session. "dynamic": the SBD document and its value may be updated every ttl seconds.
ttl	the minimum guaranteed duration in seconds that the dynamic SBD is not updated.
starttime	anchor for the starting time of SBD (SBDStart) in NTP time. This attribute shall not be present for MPD@type='static'. If absent, SBDStart is obtained as the following: <ul style="list-style-type: none"> <li>• If the SBD descriptor is included in the MPD element, the anchor is MPD@availabilityStartTime.</li> <li>• If the SBD descriptor is included in a Period's element, the anchor is the PeriodStart.</li> </ul>
duration	duration (in seconds) to which SBD is applied.
loop	for value "true", after running out of all Timeline or Orderline elements, the new set of Timeline or Orderline element(s) is added by repeating the same element until the session ends, i.e., all the remaining segment requests of the session shall have query according to this element.  for value "false", if the Timeline or Orderline element(s) ends before the end of the session, no query is added to the remaining segment requests in the session.
Timeline	values with their time values.  Either Timeline or Orderline shall be present but not both.
Orderline	values with their order values.  Either Timeline or Orderline shall be present but not both.  This item shall not be present when MPD@type='dynamic'.

Element	Description
v	list of values in order matching their names in keylist , separated by white space. Default value is specified in Key@defaultValue attribute.
s	start of the time range to which the value applies. The anchor of this time is the SBDStart parameter. SBDStart is obtained as defined in starttime semantics
n	starting number of the (sub)segment to which the value applies, i.e for "n":"5", the first 4 (sub)segments are skipped and the fifth (sub)segment is the starting (sub)segment.
r	specifies the number of consecutive (sub)segments in a time range.
d	duration of time range, unless the start of next range coincides with the start of the range described in the immediately following V element.

Element	Description
v	list of values in order matching their names in keylist , separated by white space. The default value is specified in Key@defaultValue attribute.
n	starting number of the (sub)segment to which the value applies, i.e., for "n":"5", the first 4 (sub)segments are skipped and the fifth (sub)segment is the starting (sub)segment.
r	number of additional (sub)segments in this O element using the key-value pairs, e.g. "r":"1", two (sub)segments are using the key-value pairs of this element.

# Summary

- ISO/IEC 23009-8: Information technology — Dynamic adaptive streaming over HTTP (DASH) — Part 8: Session-based DASH operations Per session
  - 1<sup>st</sup> edition: published
  - 2<sup>nd</sup> edition: coming soon
- Flexible manipulation of URL
- Different classes of URLs
- Dynamic
- Template-based or additions

The screenshot shows the ISO website interface for the standard ISO/IEC 23009-8:2022. The top navigation bar includes links for Standards, About us, News, Taking part, and Store. The breadcrumb trail indicates the path: ISO > 35.040 > 35.040.40. The main title is 'ISO/IEC 23009-8:2022 Information technology — Dynamic adaptive streaming over HTTP (DASH) — Part 8: Session-based DASH operations'. Below the title, there is an 'ABSTRACT' section with a 'PREVIEW' button. The abstract text reads: 'This document specifies the format of the Session-Based Description document and the MPD's extension to be used in session-based operations with MPEG DASH (ISO/IEC 23009-1)'. On the right side, there is a 'BUY THIS STANDARD' section with a table for selecting format and language. The table has two columns: 'FORMAT' and 'LANGUAGE'. Under 'FORMAT', 'PDF + EPUB' is selected with a checkmark, and 'PAPER' is also listed. Under 'LANGUAGE', 'English' is selected. Below the table, there is a price tag showing '110'.

FORMAT	LANGUAGE
<input checked="" type="checkbox"/> PDF + EPUB	English ▾
<input type="checkbox"/> PAPER	English ▾

110

*Thank you!*

