Fragments Video Protection Mechanism for Video on Demand Server

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ABSTRACT

Article describes the mechanism which provides access control to video fragments broadcast by the video stream server. Paper present architecture of the developed video materials provision system and principal components of the system. Approaches which can be applied in case of implementation of the above mechanism taking into account use as the broadcasting server of the commercial solution Wowza Streaming Server are described. Own mechanism of fragments video protection presented in this article was designed on the basis of one

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General Terms

Design, security

Keywords

Streaming media, security, video on demand

1. INTRODUCTION

As technologies in the sphere of media content broadcasting advanced, the need for protection of transmitted data became more urgent. Such a mechanism must allow to do a number of things, such as controlled access to the provided materials, users authentication, copy protection, etc. [2] The need for data

protection may be caused by a number of factors depending on a specific tasks. One can cite such examples as the need to protect copyright for the provided materials, control of the provided materials on a commercial basis (subscriptions), etc.

This article describes one of possible architectural solutions making it possible to control and monitor access to the fragments of video materials broadcast with the help of Web-technologies.

It should be noted that the implemented facilities are intended for controlling access to the video fragments broadcast in a VOD mode [1]. This article does not consider so-called streaming broadcasting.

2. ARCHITECTURE DESCRIPTION OF THE VIDEO MATERIALS PROVISION SYSTEM

The system of video materials provision for users includes the following components.

2.1 Broadcasting server

One of the principal components of the system.
The server provides facilities for delivering video to end users enabling them to view it "on the fly". Video is provided by creating so-called broadcasting points: links via which it is possible to obtain necessary data.
Besides, the broadcasting server is involved in the procedure of access control to the provided video fragments. For that purpose, Wowza Media Streaming Server [3] proprietary software is used as a solution

2.2 Data storage

A component for storing video and subtitling intended for broadcasting.

2.3 Web server

A component on the basis of Node.js technologies providing user interface for the procedures of users registration, authentication, authorization and provision of links to video

materials. Besides, the web server is involved in access control alongside with the broadcasting server.

2.4 Database

A document-oriented MongoDb database for storing user data (emails and hash passwords), video materials metadata (names and links) and so-called access scenarios (see below for further discussion).

2.5 User interface

The main component is a HTML5-based [4] Dash.js video player [5] that can handle the data flows provided by the broadcasting server, including the MPEG-DASH adaptive broadcasting technology (a more detailed description of the video provision protocols, as well as the description of adaptive broadcasting technology can be found in [6]).

3. VIDEO FRAGMENTS ACCESS CONTROL SYSTEM

There are several methods of carrying out such control. [7] Among them are such approaches as splitting the file being broadcasted into smaller fragments and creating a separate broadcasting point (and a proprietary broadcasting link) for each of them with subsequent provision of a certain links set to a certain user, as well as, in case the media server is provided with certain functionalities, the control logic implementation exclusively at the software level. [8]

In view of the fact that the Wowza Media Streaming Server commercial solution is used in the developed video materials provision system for which the task of an access control system is being implemented, as well as in view of the solution functionalities, we chose the second method.

The functionality provided by the broadcasting server is the capability of software processing of the received requests for broadcasting with the utilization of server-side API [9], as well as the availability of methods permitting to use a set of certain parameters in the process of broadcasting implementation (in particular, it is possible to specify the start time and the video length during its broadcasting). Those methods were used for the implementation of a proprietary module for the broadcasting server that expands its basic functionality.

It should be noted that the developed solution focused on access control implementation is applicable not only to the Wowza Media Streaming Server but to any broadcasting server subject to the support of the above functionalities by the latter.

3.1 Implementation

Based on the above, the task of implementing access control of the provided video fragments boils down to the task of shaping the "scenarios" of access rights and their application in the process of the broadcasting procedure realization.
By "scenarios" we mean a set of certain parameters applied to broadcasting, in particular the parameter determining the timepoint of the video file from which broadcasting will be started, as well as the length of the video file fragment in relation to the starting point (in seconds).

These scenarios are stored in the database, a certain key is assigned to each of them. Scenario structure example: {id_scenario: 'some_id', key : 'some_key', settings: {start_time : 0, duration : 300} }. This scenario allows to view video since the beginning duration of 5 minutes.
The diagram of process receiving a video fragment according to the rule of access is provided in a figure 1

A user sends request to the web server (1). After the procedure of authentication (2-3), he gets a list of accessible video and chooses one of them (4). Web server sends database request for receiving a scenario key which determinates access rights for this user to the selected video (5).
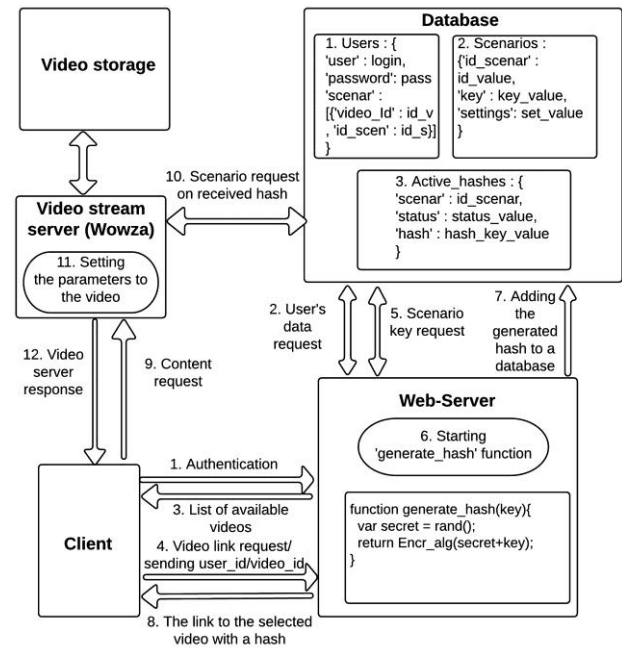

Figure 1. Process of receiving a video fragment according to the access rule

After that random string is generated in a web server, then one of encryption algorithms is applied to this string and the scenario key (6) (SHA-1, for example) [10]. The calculated hash is added to a collection 'Active_hashes' (7). User receives the link of the selected video and a hash (8) and sends a request to video stream server (9).

Video stream server receives request and searches this hash in the 'Active_hashes' collection (10), and, in case the hash is found, receives the scenario with a set of access parameters (11) and uses them for broadcasting video stream to user (12). Then the record which contain the hash is deleted from database. Thus, a hash can be used only once. The web server creates new hash for each new request. If outsider will intercept this hash, he won't be able to obtain data in a case when the user already sent request to stream server.

4. CONCLUSION

The goal of this paper was to describe one of methods making it possible to control and monitor access to the fragments of video materials broadcast. In the course of work principal components

of the developed system of provision of video materials were described. Some of possible approaches which can be applied to the solution of the task access control to video fragments taking into account use in system of provision of video records of the commercial software of Wowza Streaming Server are described. On the basis of the method consisting in use of the functional capabilities, namely Server-Side API given by the server of a broadcasting own module in the Java was realized. This module realizes processing of incoming requests and applies a set of the parameters, such as start time and duration of video broadcast to broadcasting depending on the certain hash-key. The received results are planned to use further in the developed system of video materials provision.

5. REFERENCES

[1] D. Cymbalák, F. Jakab M. Michalko, Advanced multimedia solution for interactive teaching via whiteboards over IP networks Cyber Journals: Multidisciplinary Journals in Science and Technology, Journal of Selected Areas in Software Engineering (JSSE), November Edition, 2012

[2] E. Lin, G. Cook, P. Salama, and E. Delp, An overview of security issues in streaming video, Proceedings of the International Conference on Information Technology: Coding and Computing, pp. 345-348, Las Vegas, 2001

[3] Meyn A., Browser to browser media streaming with HTML5, Kongens Lyngby, 2012

[4] Wowza Media Systems, Inc. Wowza Media Server 3 – Overview http://www.wowza.com/resources/WowzaMediaServer3/Overview.pdf

[5] Dash.js player. https://github.com/Dash-Industry-Forum/dash.js/

[6] Ali Begen , Tankut Akgul, Mark Baugher, Watching Video over the Web: Part 1: Streaming Protocols, IEEE Internet Computing, v.15 n.2, p.54-63, March 2011, DOI= 10.1109/MIC.2010.155

[7] Michalko, M., Bobko, T., & Fogaš, P. Protected streaming of video content to mobile devices. Cyber Journals: Multidisciplinary Journals in Science and Technology, Journal of Selected Areas in Telecommunications (JSAT), 2014 Edition, Vol. 4, No. 14

[8] S. Sevryukov, Y. Griva, A. Matlash, Review implementations of access control system to video fragments. The XLVI annual international conference control Processes and Stability (CPS'15), Saint-Petersburg, 2015

[9] Wowza Media Systems. (2006-2014). Wowza Media Server 3 - Server-Side API https://www.wowza.com/resources/WowzaMediaServer_ServerSideAPI.pdf

[10] Eastlake, D. 3rd and P. Jones, "US Secure Hash Algorithm 1 (SHA1)", RFC 3174, September 2001