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IMPROVING THE EFFICIENCY OF STREAMING VIDEO PROCESSING THROUGH THE USE OF SERVERLESS TECHNOLOGIES

Abstract: An architecture with classical dedicated servers for video analytics is considered, and architecture using serverless technologies for video analysis with more than one video streaming source is proposed. A comparison of two architectural approaches is made, and for the revealed shortcomings the architecture with the use of serverless functions is offered.

Keywords: video analytics, static computing resources, serverless functions, frame-by-frame video analysis.

Introduction

The development of intelligent video analytics is based on two main technologies - tracking and identification. On the basis of the rules laid down in the algorithm of video analysis, all the functionality of the system is built, which is essential for the construction of modern video surveillance systems.

Tracking is when a video processing algorithm looks for motion in a frame, identifies and classifies a moving object, describes its characteristics (size, color, speed). There can be quite a lot of tracking options (video detector) [5].

Situational detectors are when an object crosses imaginary lines in a frame, after which the system emits an alarm:

- the intersection of the object of a straight line in a given direction;
- traffic in the area;
- the exit of the object from the zone;
- stopping the object in the area;
- the subject left in a zone.

Service detectors are functionality (software) that manufacturers already build into their IP cameras:

- lens overlap detector;
- camera illumination detector;
- displacement detector, camera deflection;
- background change detector;
- lack of focus detector.

Also, tracking includes intelligent search in archives [2]. This is a search that helps the operator to quickly find the right material when the detector is triggered when the exact time of the event is not known.

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Problem statement

It is necessary to offer approaches to the problem of analysis of the input video stream in real-time. Under the analysis we understand the frame-by-frame processing of the video stream, in order to translate the data into a formalized model, ie, object recognition, classification, and transformation of domain objects seen by the camera into domain model system objects that can be manipulated at the level of system logic.

Analyze the functional requirements of a system in which more than one video stream source operates, transmitting data simultaneously in real-time to solve the problem of frame-by-frame recognition, and propose solutions under the following operating conditions:

- the number of sources changes dynamically;
- the number of sources should not affect the video stream recognition process of each source;
- processing takes place in real-time
- the system transmits to the client recognition system a formalized model that can be used by the client system

Solving the tasks

Implementation of the task of video analytics using statically allocated resources (servers) and classical analysis algorithms also involves maintenance of data warehouses, maintaining the availability of the entire system and each component separately, in addition, meets the security requirements of transport channels and storage. When using an architecture with statically allocated resources, as shown in Fig. 1, there are the following disadvantages:

- computing resources are limited by static servers, which negatively affects all system operations at abrupt or increased load;
- maintenance and maintenance of infrastructure requires knowledge and human resources, which negatively affects the cost of the system;
- functional changes to processing (adding new algorithms or sources) require partial or significant changes in the logic of thread processing servers, and the deployment of new functions creates a negative load on the system as a whole and requires testing the performance of the entire system with each release.

The proposed server-free architecture solves the identified shortcomings, as well as has a positive effect on the modularity of the system, the possibility of functional expansion of the system, and is less demanding on the technological stack of the entire architecture. When implementing the task of parallel processing of video streaming data with abrupt load (dynamic addition of sources), the proposed architecture makes it possible to avoid the impact of processing each source on system performance, ensures isolation of processing processes, and solves the problem of competitive access to repositories or databases [5]. In addition, the use of cloud computing technology in the implementation of the selected architecture provides the following advantages:

1. high availability of all system modules, which is guaranteed by SLA cloud providers, which reduces the cost of maintenance and expands the functionality of the system;

2. high deployment speed, without negative impact on system performance.

3. implementation of new functional requirements does not have a negative impact on existing modules, which reduces the cost of testing the system with each new release;

4. jump-like loads caused by a dynamic change in the number of sources of video streams is solved by automated scaling of serverless functions

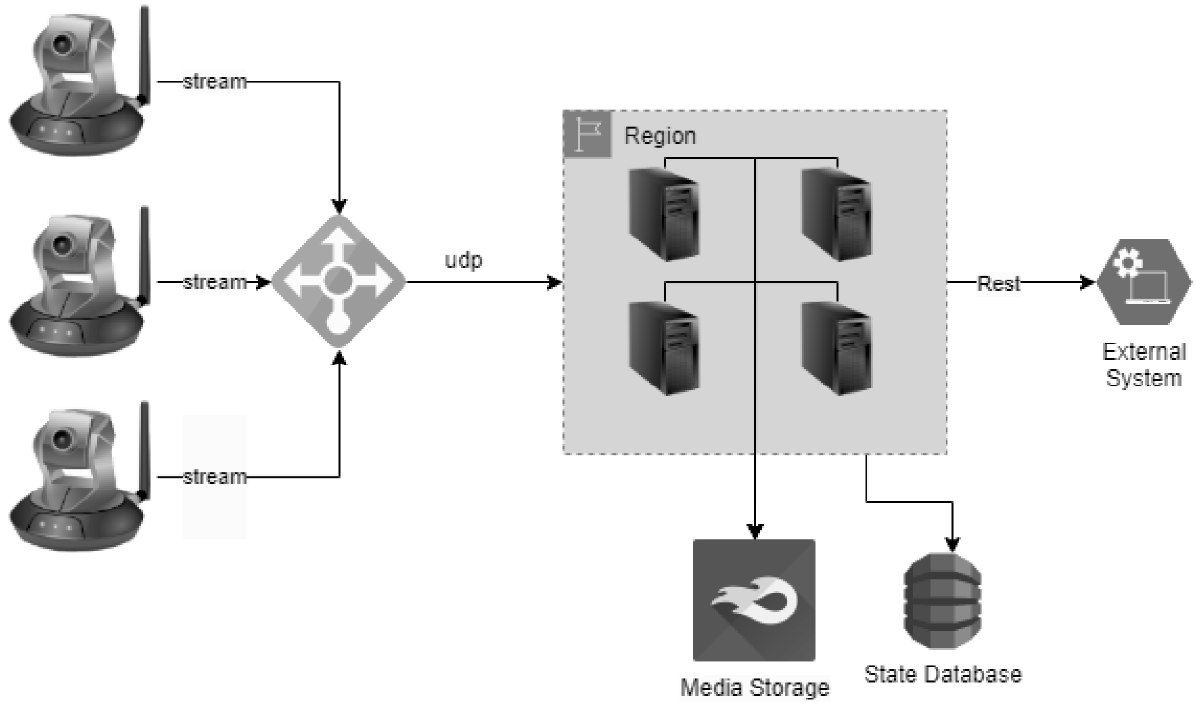

Figure 1. General architecture scheme of video analytics system

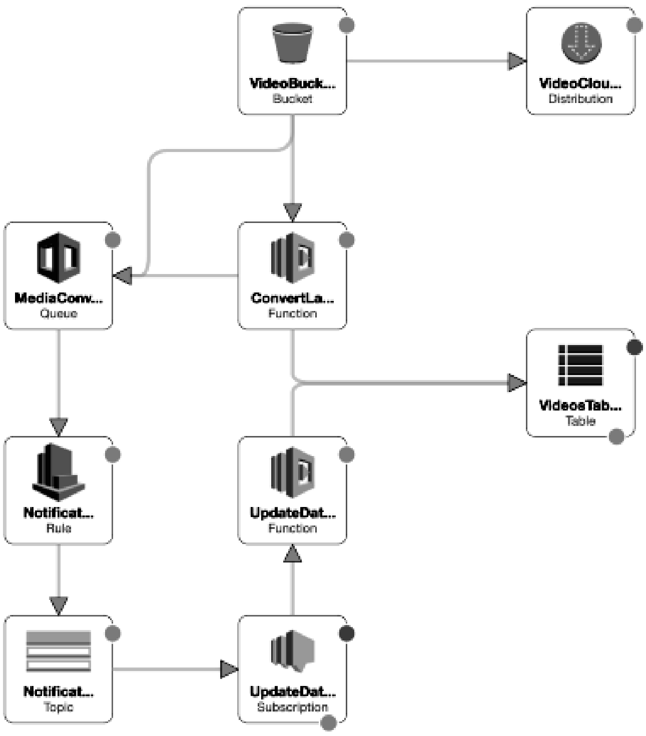

Figure 2. Architectural scheme based on cloud services

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The speed and modularity of the proposed architecture solve the identified shortcomings of the architecture with statically allocated resources, and also allow to reduce downtime of computing power by automatically quickly dynamically removing resources that are not used at a particular time or adding additional resources with increasing load [6].

Because there are no requirements for analysis algorithms yet, an improved architecture based on cloud functions is proposed, which allows you to use, add and develop any recognition algorithms by encapsulating the logic in the middle of specific functions. Cloud functions are not only agnostic to algorithms but also remove restrictions on the use of a particular programming language, as each function works in isolation from the others and can be written in any language (Fig. 3).

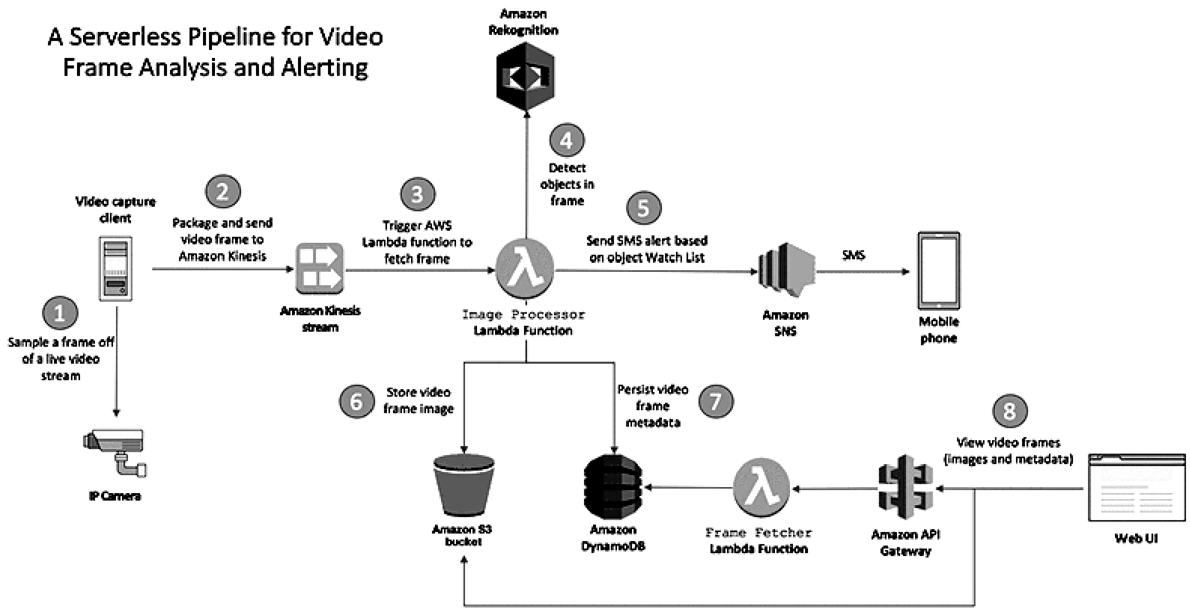

Figure 3. Architectural scheme of the system based on cloud functions

Conclusions

The analysis of functional requirements of the system in which more than one source of a video stream function is carried out and the decision for the decision of the set tasks are offered:

1. the number of sources changes dynamically;
2. the number of sources should not affect the video stream recognition process of each source;
3. processing takes place in real-time
4. the system transmits to the client recognition system a formalized model that can be used by the client system

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