CLOUD BASED VIDEO SURVEILLANCE

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Abstract: ***Security of data has been a major concern for decades to the government as well as to the private enterprises. Previous advancements in cloud computing and cloud storage have succored to snag such a video surveillance system accomplished to dominate the high resolution videos. After pondering over the various service models like Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS) it has led us to propose that cloud based video surveillance system could be used to prevent thefts, lower the expense, increase the portability of data, high data security and faster data processing.***

Keywords: **Cloud Computing, IP Cameras, Service Models, Video Surveillance System, Cloud Server**

I. Introduction

IP Cameras could be used to store the data onto the Cloud system thereby expanding the flexibility and functionality of the surveillance system. Video Surveillance System have grown from the closed-circuit transmission video (CCTV's) environments into self-contained digital video recorders (DVR) and then to Internet Protocol (IP) Cameras. CCTV's require its own computational power for processing the data and analyzing it but the IP Cameras requires only electric power to activate it and the further data processing and storage is provided by the Cloud System. Cloud system provides different services for the implementation of the Cloud based Video Surveillance System. This System has different advantages and disadvantages which could be understood further.

2. Cloud Computing

Cloud Computing can be defined as a system of computation that provides the company or the user an access to its computing services as well to its storage facilities over the Internet. In this system, the user or the company need not to worry about the computation it requires for processing and analyzing the data. In this system, all the data processes runs on the Cloud system and its output could be attained at the client side. In case of LAN systems, every other client gets the IP address of the other IP's connected in the network but in Cloud system, each device connected to the network is anonymous to every other device in that network.

3. Architecture of Cloud based Video Surveillance System:

The video surveillance system based on cloud works in a way that the devices in the network follows a procedure in their way to store the data to the Cloud server. The architecture of Cloud based video surveillance is composed of five units.

1. IP Cameras: These cameras works by transmitting the encoded video signals to the Network Video Recorder (NVR) through Internet Protocol (IP).NVR is a software program which is used to record the video data in digital form onto the hard drive or other storage device. Each IP Camera has a unique IP address. IP Cameras used in security are provided with only power to keep it working.

2. Surveillance Client: Video Surveillance is a software that can be used as tool for the management and centralization of a surveillance system using NVR and IP Cameras. It provides the user with different functionalities for the data being sent by the IP Cameras such as playback various configurations etc.

3. Web Server: It is a system which accepts the incoming network connections using Hypertext Transfer Protocol (HTTP) and allows the transfer of data in either ways. It maintains the allowance of the network requesting the data. They are capable multiple of maintaining multiple users at the same time.

4. Cloud Processing Servers: It receives the digital information of the recorded video through the Web server from the IP Cameras. This data is then processed within the Cloud Processing Server providing the visual effect to the data and after processing, it is sent back to the Cloud Storage Server. The data is sent depending upon the network status of the Cloud system.

5. Cloud Storage Servers: This server has the job of accumulating the processed data sent by the IP Cameras permanently through a secure channel. These data are sent to the client through the web servers as and when requested.

The below figure shows the diagrammatic representation of the Architecture of Cloud Based Video Surveillance:

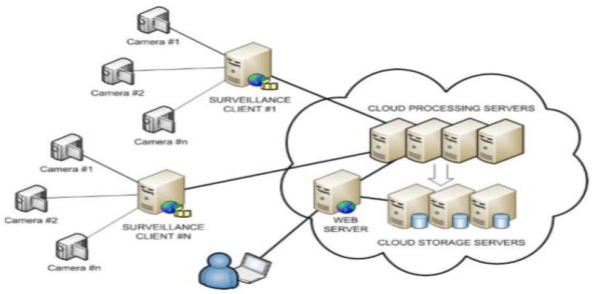

Figure 1: Architecture of Cloud based Video Surveillance

4. Cloud Computing Service Models

A.

Video Surveillance System using IP Cameras uses different Service Models for its implementation. Cloud Computing Model is branched into three different varieties depending upon the demands of the user or the enterprise i.e. Software as a Service (SaaS), Platform as a Service (PaaS), Infrastructure as a Service (IaaS). Software as a Service (SaaS) Service model is an approach through which the user or an enterprise is served with the user interface of the software application as demanded. Platform as a Service (PaaS) model is an approach through which the user or the enterprise is provided with a platform or a framework for the deployment or development of a software over the cloud. Infrastructure as a Service (IaaS) model is an approach through which the user or the enterprise an opportunity to manage the servers, storage, networking technology, cables, firewalls, etc.

4.1 Software as a Service (SaaS)

SaaS is a service model that is designed to provide the user or the enterprise a user interface of a software applications capable of providing an access to their data stored within the cloud server. In a Cloud system, all the devices are connected in a network anonymously over the internet to the Cloud server which provides access to its data to all the devices in the network. These applications are actually installed and processed within the cloud server instead of being locally installed on the user's system. The applications provided by the cloud runs irrespective of the users Operating System. This service model provides the user an advantage of reducing the time spent on installation and configuration of the application.

4.1.1 Advantages of SaaS

- No additional Hardware costs: The Cloud providers provides the power required for processing the applications free of cost.
- No initial setup costs: Once the SaaS application is provisioned, its ready to use within couple of hours.
- Pay per Use basis: The user or the enterprises are charged only for the period it's been provisioned.
- Updates are automated: Cloud provider automatically deploys the updates for the applications free of cost.
- Cross device compatibility: The SaaS applications can be used irrespective of the compatibility of the device.

4.2 Platform as a Service (PaaS)

PaaS is a service model in which the cloud provider provides the programming languages, frameworks, libraries and tools to the user or the enterprise to develop and deploy the software applications as per their requirements. It enables the development, testing and deployment of applications quicker, simpler and efficient. Services and features provided to the users are invariably updated, by consequently upgrading the existing features and adding additional features to it. In PaaS the users are charged pay-per- use basis. This service model is generally preferred by the enterprises in case if they are in need of custom application capable of solving a specific problem of the enterprise. In today's generation, companies like Amazon Web Services, Salesforce.com, LongJump, Microsoft Azure, IBM,RedHat, Cloud Foundry etc. have a big market share in PaaS.

4.2.1 Advantages of PaaS

- No cost for physical Infrastructure: The user are from purchasing the hardware and employing the IT personnel's for its maintenance. All these things are looked after by the Cloud provider. So, the users are hassle free to focus on the development of the applications.
- IT personnel are not required: For developing a PaaS application, technical experts are not required. Example of such an application is WordPress.
- Flexibility: There are no constraints for selecting the features to the user. They are free to select the features depending on the need of the user.
- Adaptability: Applications can be customized as and when required.
- Security: The Cloud provider provides data security in addition to backup and recovery.

4.3 Infrastructure as a Service (IaaS)

IaaS service models is a flavor of the Cloud Computing Services apart from SaaS and PaaS. This service model defines the approach of managing, monitoring and controlling the virtual server spaces, networks connections, bandwidth, IP addresses and load balancers. These virtual server spaces are provisioned from the various data centers of the cloud providers across the globe and they themselves are responsible for its maintenance and emerging updates. This service could be beneficially utilized by the enterprises in turn to have a cost-effective solution without being indulged into maintaining the physical hardware's. Nowadays IaaS

providers also offers databases, messaging queues and many of the services over this virtualization layer.
We can list out ways in which IaaS can be utilized by the enterprise:

- Enterprise Infrastructure: In this method the enterprise could demand for the service it requires and the Cloud provider looks after the maintenance of the Cloud server provisioned by the enterprise and protects the transfer of their sensitive data within the network.

4.3.1 Advantages of IaaS:

- Scalability: The resource can be provisioned as and when required by the client as it would be available at any time thereby reducing the delays in expanding capacity.
- No charge for Hardware: The enterprise won't be charged for the physical Hardware and it would be maintained by the Cloud vendor thereby saving the time and cost of doing the same on the client side.
- Independent of Location: This service could be approached from any location provided that the user has an Internet connection and the security protocol of the cloud allows it.

5. Types of Cloud System:

Today's Generation requires Cloud System depending on the accessibility of the user to the given Cloud System such that for an instance, in a particular enterprise the information regarding the company's secret missions stored in a Cloud System should be inaccessible to their lower level employees. This raised three different types of Cloud systems.

1. Public Cloud: This Cloud system provides their services to anyone on pay per use basis. Any enterprise requesting for provisioning of their services are not required any minimum credentials. This system is provided in a virtualized environment, build up using merged share of physical resources, and could be attained through Internet.

2. Private Cloud: This Cloud System works in a way that only specified users can operate under the system. It is developed within a distinct and secure environment. As compared to public Cloud system, it provides the computation power as a service in the virtualized environment.

3. Hybrid Cloud: This Cloud System is an integrated system which provides the hybrid service of cost effectiveness of the public cloud and accessibility provisions of the private cloud to the enterprise. This kind of Cloud System in used in hosting e-Commerce websites which makes it secure and scalable whereas their advertising site which would use public cloud will be cost effective.

6. Future of Video Surveillance System

By looking towards the greater development and enhancements in cloud computing, it is possible to revolutionize the surveillance system through Cloud system. It is required to evolve the resolution, functionality, expandability analyzing abilities of the surveillance system. But it will require more and more consumption of computation power as well as the physical resources thereby increasing the cost of provisioning the resources.
Companies like Google, Microsoft, Amazon, SafeSource provides Cloud system on a pay-per-use basis. The table shows a list of different Cloud vendors along with their pricing.

7. Conclusion

Cloud based Video Surveillance System could be beneficial to the enterprises in aspect of security but it would be completely reliable on the Internet. Even though it has many advantages but the pricing would be higher than buying the physical hardware instead. It would also require higher bandwidth in case the enterprise targeting to store high resolution videos. So, we can say that this sort of system has numerous advantages but its disadvantages can't be ignored. This system is recommended for those enterprises which is expanding expeditiously and whose security is preferred to be their highest priority.

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