Design and Implementation of Integrity Preserved Content Delivery Service for Vehicle Black Box

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Introduction

- **Vehicle Black Box**
  - Rapidly growing market
  - Benefits brought by Black Box Content
    - Clarity the locus of responsibilities for accidents
    - Perform surveillance, prevent car damage
- **Problems Statement**
  - Lack of a systematic way to manage and distribute the content from heterogeneous black boxes to various devices
  - Lack of integrity preservation for black box content, which avoids legal force
- **Contributions**
  - Propose black box content delivery service and system architectures by guaranteeing the content integrity is preserved
  - Implement smartphone applications on top of the proposed architecture to show the applicability of the proposed architecture

Service Architecture

- **Black Box Content Delivery Service Architecture**
  - The black box content is collected from each individual black box to centralized Content Management Server (CMS)
  - The CMS analyzes, processes, manages and distributes the content to the third parties (e.g., Broadcast company and insurance company) and individuals who have interest to the content

System Architecture

- The system is composed of three sub-systems
  - **Content Provider**: extracts black box content from the hardware black box, and uploads it to the content management server
  - **Content Management Server**: collects content from content providers, and delivers it to content consumers
  - **Content Consumer**: is anyone who watches and shares black box content on the content management server

Security

- **Purpose**
  - To give the legal force to black box contents stored in the server
  - To accept video from the authenticated black box only
- **Requirements**
  - **Integrity**: Contents generated by black box should be transferred and stored without modification.
  - **Non-repudiation**: Each black box content should be identified by the black box which generates the contents.
  - **Access Control**: Only the owner of black box should have rights to access to the uploaded black box contents.
- **Secure Upload Process**
  - Each black box registers its S/N to the server and receive a private key in advance.
  - The server can authenticate the black box by verifying its private key using challenge-response authentication.
  - The owner of the black box is excluded during the process since he/she is one of the potential attacker

Implementation & Prototype

- **System Implementation**
  - **Content Collection**: content extraction, tagging the meta data, content upload
  - **Content Transcoding**: perform multiple content transcoding in various content format for the purpose of supporting heterogeneous devices
  - **Content Sharing**: support real-time content streaming to various smartphone platforms, by making use of Apple HTTP Live Streaming (HLS)

Concluding Remarks

- **Conclusions**
  - We proposed a black box content delivery service architecture with preserving integrity of black box content
  - We implemented a prototype program for validating the proposed architecture
- **Future Research**
  - Preserve the user privacy by applying video analysis techniques such as object detection and anonymization
  - Detect certain events for selective content delivery in order to reduce traffic