Semantic-based Quality of Service Management for Real-time WebRTC Streaming Service

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1 Introduction

Game streaming service refers to a game service that executes and processes games from a server device and streams game screen as a video to client devices over network. The game streaming service is entering the mainstream gaming market with the emergence of various cloud game streaming services such as Google Stadia [1], NVIDIA GeForce NOW [2], and PlayStation Now [3]. In a game streaming service, a central server computes all heavy computations, including game algorithms and texture renderings, facilitating high-end game experience on various platforms such as smartphones and smart TVs. As complex computations are offloaded to the central server, the essential factor of game streaming is to manage user experience of clients.

To augment user experience, Samsung Electronics is developing low-latency WebRTC based game streaming solution that streams game screen from smartphone to smart TV in a local area network. The WebRTC specification addresses low communication latency between server and client devices. However, developing game streaming solution still requires addressing two important aspects.

First, although the WebRTC game streaming solution assumes that the TVs and Android phones are in same local network, all types of delay should still be considered to meet the quality of experience. As the end-to-end delay affects the quality of service, the system integrates a fast and simple form of ontology-based RDFs to share information relates to delay as well as for automatic end-to-end delay management.

Second, the game input control is entered from a remote device; thus, an input interface handler should be available on Android. The Android platform does not provide touch event emulation due to security and so, the Android platform discards the touch input event from the browser to the game applications. In order to overcome this, the prerequisite of the solution is to have manufacturer

SDK support for emulating touch events. And the smart TV and the smartphone should share whether the input can be processed on the smartphone by checking the manufacturer information.

2 Ontology for WebRTC Game Streaming Service

Game Streaming Scenario In the Samsung Electronics game streaming service, users interacts with smart TV. User gives game inputs via keyboard and mouse connected to TV. The smart TV receives encoded audio and video streams from smartphones and renders game streams on TV. Since the service is using WebRTC for streaming, the smartphone transfers audio via WebRTC audio channel and video via WebRTC video channel. The smart TV sends the input event to smartphones using WebRTC data channel.

Smartphone translates the received user input events to touch events. The smartphone emulates touch input to the game. It also encodes the audio and video stream.

RDF Usages in the Game Streaming Service Prior to connection establishment between a smart TV and smartphone for game streaming, the WebRTC gaming system shares multiple information and investigates availability. To reduce the game input and streaming latency, the smart TV monitors Wi-Fi signal strength(RSSI in db) from the wireless access point and compares with smartphone's Cell-Signal strength. The smart TV establishes connection directly to where the signal strength is stronger.

The smart TV and the smartphone not only share network information and manufacturer information but also share screen resolution, hardware encoder/decoder availability, and numerous game streaming relevant information. The service on TV automatically parses the information shared from smartphone. As the smartphone continuously generates the information associated to game streaming, it becomes necessary to manage information about where the data comes from, who generates the data, and how the information changes.

In our work, we develop a semantic layer on WebRTC game streaming service. The semantic layer manages metadata and combines multiple RDF information to maximize user experiences. From the RDFs, the service system automatically finds the appropriate type of encoder/decoders, screen resolutions, game availabilities, and network configuration for quality of service.

References

1. Google: Stadia. https://stadia.google.com/
2. NVIDIA: Geforce now. https://www.nvidia.com/en-us/geforce-now/
3. Sony: Playstation now. https://www.playstation.com/en-us/explore/playstation-now/