

# Real-time Adaptive Advertising<sup>1</sup> Framework Based on MPEG-21 for Multi-screen IPTV Environment

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**Abstract**--This paper presents an advertising framework to ensure the targeted advertisement service for heterogeneous IPTV client devices with different capabilities and subscribers with different preferences by providing advertisement content selection and filtering mechanism in real time. To support adaptive advertisement service in multi-screen IPTV service environment, we suggest a new advertising framework using XML schema based on MPEG-21 DIDL (Digital Item Declaration Language).

## I. INTRODUCTION

Recently, IPTV service providers are trying to deploy the multi-screen services that provide IPTV services through various consumer devices such as high-definition IPTV set-top box, personal computers, mobile phones, etc. Also, for raising revenue, they are looking for the advertisement system that is able to present the suitable advertisement contents on various IPTV client devices with different capabilities and that is able to deliver the targeted advertisement contents to each user depending on user profile, user behavior, device capabilities, and/or their service policies. For the success of targeted advertisement services through different types of devices and different preferences of users, adaptive advertisement contents should be provided.

ISO/IEC 21000-2 (a.k.a. MPEG-21) DIDL [1] provides basic framework of choice-selection-condition through which individual multimedia resource can be selected to provide an adaptive consumption of multimedia content. ISO/IEC 21000-7 DIA (Digital Item Adaptation) provides various tools of describing terminal, network, and user environment as well as a tool for adaptation of contents, to achieve interoperable transparent access to distributed multimedia content by shielding users from network and terminal installation, management and implementation issues [2]. Generally, DIA tools could be used to satisfy various needs on transmission, storage, consumption constraints, and Quality of Service management. But, current DIA tools are not optimized to describe conditions for presentation of adapted advertisement content on user terminal by selecting and filtering Digital Items.

In this paper, we propose a new advertising framework to provide functionality of selecting and filtering advertisement contents based on IPTV client capabilities, user information, and service policies in real time. Also, we design a new

description language to describe the conditions for the advertisement contents structured as MPEG-21 DIDL [1] in a form of XML schema [5] called Real-time Adaptive Advertisement Description Language (RAADL). Advertisement contents described as MPEG-21 Digital Items are selected and reconstructed in the adaptation process, to be optimally presented at each individual environment, based on the delivery context.

## II. REAL-TIME ADAPTIVE ADVERTISEMENT DESCRIPTION LANGUAGE

RAADL is a new description language in a form of XML schema, and can describe functions of selecting and filtering advertisement contents based on the factors such as device capabilities, user information, or service policies. In addition, we design RAADL to be harmonized with MPEG-21 DIDL easily.

We define a new complex type named *DCCondition* to describe conditions for selecting and filtering Digital Items to present an adapted advertisement content [3]. *DCCondition* type is extended from *StatementType* type of DIDL for the harmonization with DIDL. *StatementType* type provides a textual value that contains descriptive, control, revision tracking or identification information [1]. Also, to minimize the number of letters used in a XML document and the depth of the XML tree of the condition description, it is proposed to use the Reverse Polish Notation (RPN), which can be easily implemented using stack-based functions [4], to express complex conditions based on mathematical expressions such as Boolean expressions, comparison expressions or arithmetic expressions. Fig. 1 shows the structure of *DCConditionType* type. *DCConditionType* type can contain *StackEntry* elements to describe condition expressions for selecting and filtering Digital Items as the RPN form.

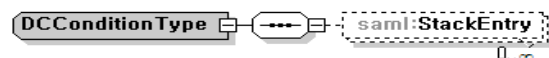


Fig. 1 The structure of *DCConditionType* type

*StackEntryType* type is a base abstract type to represent an operator or an operand for describing stack entries that are members of the stack operation. In RAADL, an operand of the stack function may contain a constant value, or a *DCFunction* that is a function for taking the characteristics of the device, service policy, user information, and any other aspects that affect execution and presentation of advertisement contents on a client device from the system. The stack entries are classified into three groups of types based on the data type of

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the stack entry or the return value type of the stack entry: *BooleanEntryType* type, *StringEntryType* type, *NumericEntryType* type.

The *DCFunction* types define the functions that check and return input factor values that may influence the advertisement content adaptation of the RAADL filtering engine in the server, or the client. Table I shows the characteristics of *DCFunction* types. It is not an exhaustive list of the *DCFunction* types, but is a list of minimum set of *DCFunction* types used in our system.

TABLE I  
THE CHARACTERISTICS OF THE *DCFUNCTION* TYPES

Characteristics	Information
Device Capability	Client Device type, Operating System, Supporting Codec (Video, Audio, Image, etc), Input Interface, Output Interface, Screen Resolution, Virtual Machine, etc
Device State	Power Level, Orientation of Screen, etc
User Information	User Profiles, User Preference, Usage History
Connection	Bandwidth, Network Protocols, Latency, etc
Location	Geographic Coordinates, Time of Day
Locale	Local Language, Local Time Zone
Service Policy	Subscription Status, Content Restriction, Security, Privacy, etc

### III. REAL-TIME ADAPTIVE ADVERTISEMENT PLATFORM

Figure 2 shows the structure of real-time adaptive advertisement platform using RAADL documents. Currently, most of IPTV service providers serve IPTV applications and advertisement contents that are implemented using formats such as XHTML, Java, or Flash. The RAADL advertising content authoring tool generates a RAADL document which wraps a legacy advertisement content for enabling this content suitable for various users and various IPTV terminals that have different device capabilities. When a user wants to consume an application, the requested application which includes RAADL document should go through at least one RAADL advertisement content filtering engine before being presented to the requesting client. RAADL filtering engine can be located at any of the servers, or a client. Generally, the RAADL advertisement content filtering engine in a server performs the process of selecting and filtering the RAADL document based on input factors concerned with service policies and user subscription information. The filtering engine in a client will be operated if it is necessary that it should perform the process of selecting and/or filtering by real-time device state information and user information which user does not want to deliver to any servers. It determines which specific component or item of MPEG-21 DIDL to be selected and/or filtered by interpreting *DCCondition* elements of RAADL and *Condition* elements of DIDL. For the selection and/or filtering of appropriate component or item, the delivery context shall be examined and matched against the *DCCondition*. Once the selection and filtering process is performed, the application including the set of selected

advertisement contents can be rendered by a parser and/or a renderer in a client.

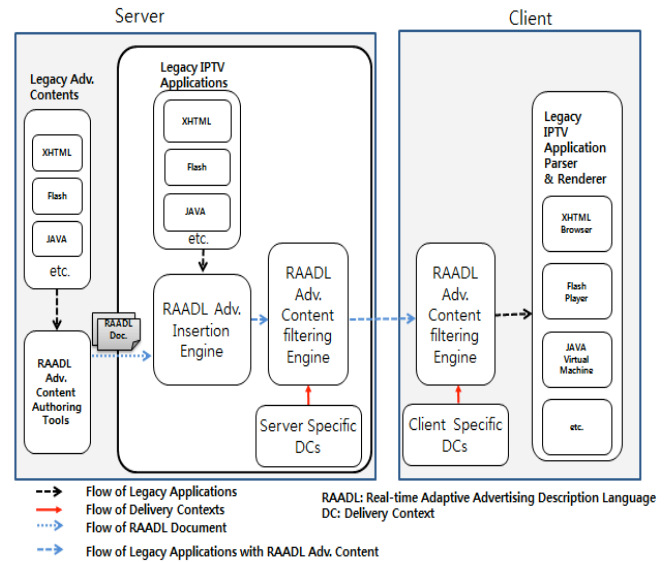


Fig. 2 The structure of the real-time adaptive advertisement platform

### IV. CONCLUSION

In this paper, we propose a new advertising framework to provide functionality of selecting and filtering advertisement contents based on IPTV client capabilities, user information, and service policies in real time. Also, we design a new description language to describe the conditions for the advertisement contents called Real-time Adaptive Advertisement Description Language.

By using this advertising framework, IPTV Service Providers can apply various targeted advertisement services (e.g. user-targeting, device-targeting, location-targeting, etc) to IPTV service environment easily. Furthermore, this advertising framework provides scalability of an advertisement content which is presented on the various client devices simultaneously.

### ACKNOWLEDGMENT

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