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Metadata associated Network Services and Capabilities

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Abstract

This paper discusses the problems of content delivery in heterogeneous networking environment, and proposes framework architecture based on metadata. The proposed architecture will provide high-quality and user-friendly network services by using metadata about content as well as user's requirement.

1. Introduction

Recent progress in IP based optical backbone networks as well as broadband access environment such as digital subscriber line (DSL), CATV internet and fiber to the home (FTTH) allowed multimedia contents to be delivered to a wide scope of users. Wireless devices are adding the support for the standard Internet communication protocols to provide a rich application environment, which enables delivery of information and interactive services to digital mobile phones, pagers, personal digital assistants (PDAs) and other wireless devices.

Over such heterogeneous network and terminal device environment, contents need to be delivered seamlessly and in a manner to meet user's requirement and preference. A number of current content delivery services, however, are managed by provider's-side logic without knowing user-side requirements and/or usage environment. If the network knows user's profile, status and context, it will be possible to deliver contents in more convenient and suitable way for the user. Metadata plays an important role for above objectives.

This paper proposes integrated framework architecture of content delivery based on metadata. It provides a policy based content delivery control by using content metadata and user metadata. Two aspects; "Metadata driven QoS control" and "Metadata driven One Source Multi-Use", are discussed.

2. Metadata driven QOS control

Figure 1 shows metadata driven QoS control architecture. The basic idea of this architecture is to estab-

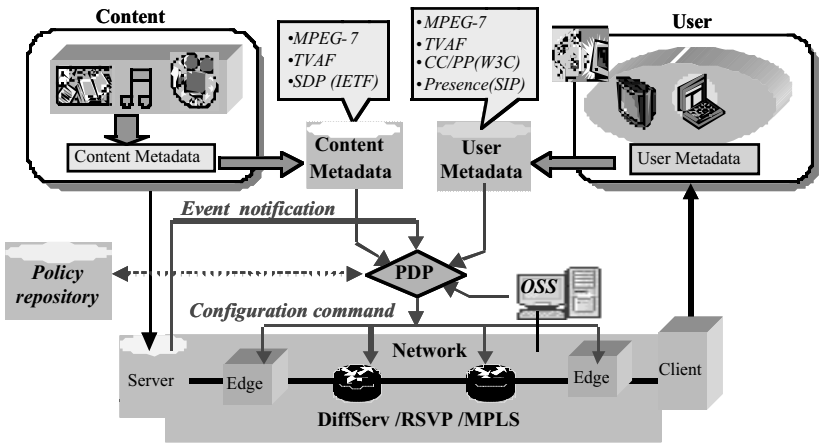

Figure 1. Metadata driven Qos control

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lish feedback mechanism to reflect user side requirement in content delivery services. QoS level segregations such as quality assured content delivery or express delivery will be achieved, by harmonizing both content requirement and user requirement in network resource allocations through means of metadata.

Content metadata are defined in MPEG-7 [1] and TV Anytime Forum (TVAF) [2]. TVAF discriminates "content description metadata" that include content title, synopsis and genre, and "instance description metadata" that describes location, usage rules and delivery parameters. As for user metadata, user profile as defined in CC/PP (Composite Capabilities/ Preference Profiles)[3] of W3C includes terminal capabilities and user preferences. User metadata as defined in MPEG-7 includes user preference and usage history. Presence information as defined in IETF-IMPP (Instant Messaging and Presence Protocol) working group [4] includes user and/or terminal availability about participating in communications over networks.

In Figure 1, when a user requests a particular content to a server, event notification is sent to Policy Decision Point (PDP). The PDP refers to content metadata and user metadata to know about their attributes. The status of available network resource to deliver this particular content is obtained from Operation Support Systems (OSS) as needed. Then the PDP imports relevant policies that are stored in the policy repository to make a decision and sends configuration commands to relevant Policy Enforcement Points (PEPs).

3. Metadata driven One-source Multi-use

Recent rapid progress in wireless technologies is bringing ubiquitous service into reality. Internet access from mobile phone and/or personal data assistance (PDA) now allow computer and communication devices to continue communications even when mobile.

In Figure 2, a user who is viewing a MPEG-2 video by a personal computer at his/her office (or home) goes out and wants to continue viewing the same content by a PDA or a mobile phone. When the user switches the terminal device from PC to PDA (or mobile phone), the terminal device capabilities and access network conditions changes, thus arises the need of content adaptation to meet the new usage environment as well as user preference. Usage environment and user preference are provided by metadata and stored in user metadata database.

As examples of content adaptation, real-time transcoding, and source selection are envisaged. In real-time transcoding, the MPEG-2 video format is transcoded to MPEG-4 video format in a real-time basis to adapt to lower bit-rate of portable devices. MPEG-7 "MediaTranscodingHints DS" metadata can be used for this purpose. In source selection, the original video file is encoded in several video formats beforehand, so that an adaptation server can select a suitable source at content request depending on the terminal capability. MPEG-7 "Variation DS" metadata can be used for this purpose. These adaptation metadata are stored in the policy repository.

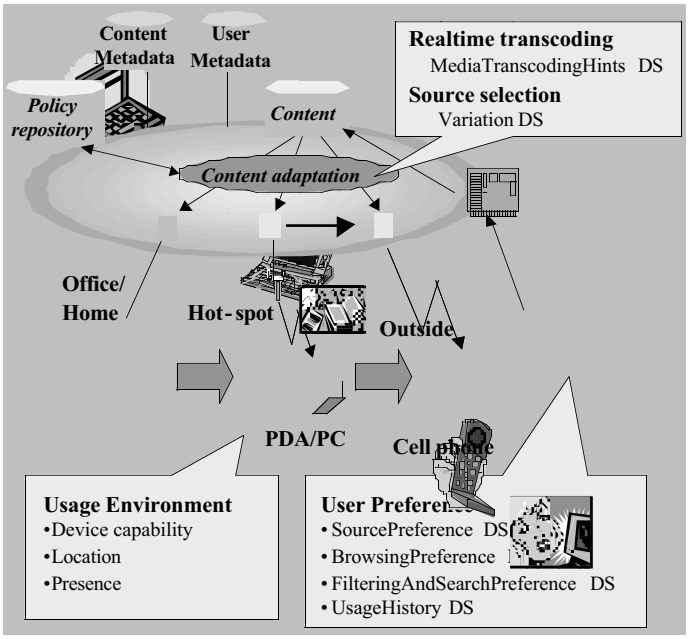

Figure 2. Seamless roaming with content adaptation

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4. Conclusion

By using proposed framework architecture, content delivery service providers can establish particular policies of how to control content delivery by harmonizing various requirements described by metadata to achieve user-oriented services.

References

[1] "Overview of the MPEG-7 Standard ", Dec. 2001.
[2] http://www.tv-anytime.org/
[3] W3C, " CC/PP", W3C Note 27, July 1999.
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