

A lightweight brokering system for content/service charging in a cellular network centric business model

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Abstract

Cellular operators offer voice services for years and own a solid amount of users with a certain authority on running cellular business. Recently, various fascinated value added contents and services are emerging in the post-voice era. To extend the business and leverage the exiting operation and maintenance systems, operators strive to become a trusty broker that aggregates a variety of valued added services provided by lots of third-party service/content providers as well as a payment agency that collects the service/content fees into a unified bill for users. In the past, little studies had ever clearly and deeply revealed for how to practically substantiate a lightweight system for connecting users, cellular operators and content/service providers by highly exploiting the mature cellular environment to achieve a triple-win situation. In this article, we elaborate a well-constructed A.A.A. brokering system – A⁴BS sitting between the content/service providers and users to link the value chain in such a triple-play game. A⁴BS generalizes certain basic mechanisms that govern authentication, authorization, advice-of-charge issuing, accounting, billing and settlement. Through this tried-and-true system, content/service providers can focus on service creation without much attention to the end-user billing. Meanwhile, users can be charged on a transaction basis with an instant expenditure notification and have a one-stop payment in the existing cellular bill.

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1. Introduction

As cellular business has been taking off, cellular services are deemed indispensable for most people in the daily life. In the post-voice era, value added contents and services are booming. Many efforts are put on service platform construction [1,2], content pricing [3], and complex charging models [4,5]. Cellular operators strive to conduct a drive-through culture to get contents/services instantly via people's hand-held devices. Cellular users can therefore easily purchase various fascinated value added contents/services from the one-stop service center which may be operated by cellular operators and then pay the content/service fees in their monthly bill later. On the other hand, content/

service providers (CPs/SPs) may broaden their product visibility through cellular operator's assistance and earn more revenues back without investing too many advertising efforts. CPs/SPs may consequently pay more attention to the content/service innovation without worrying about annoying payment logistics toward end users. Moreover, with the endorsement from the reputed operators, customers may alleviate their anxiety while conducting transactions in the cyber world.

In accordance with the reputation of operation, cellular operators can build a trustworthy relationship among cellular users and content/service providers to conduct a network-operator-centric business [6] like i-mode as Fig. 1 shows. A middle-tier system must play the central role in-between in such a model and the cellular operator controls the user's profile and charging. The developing OSA/Parlay charging API [7] introduced by 3GPP [8] seems an ideal but under-constructed and future-fully-realized solution to

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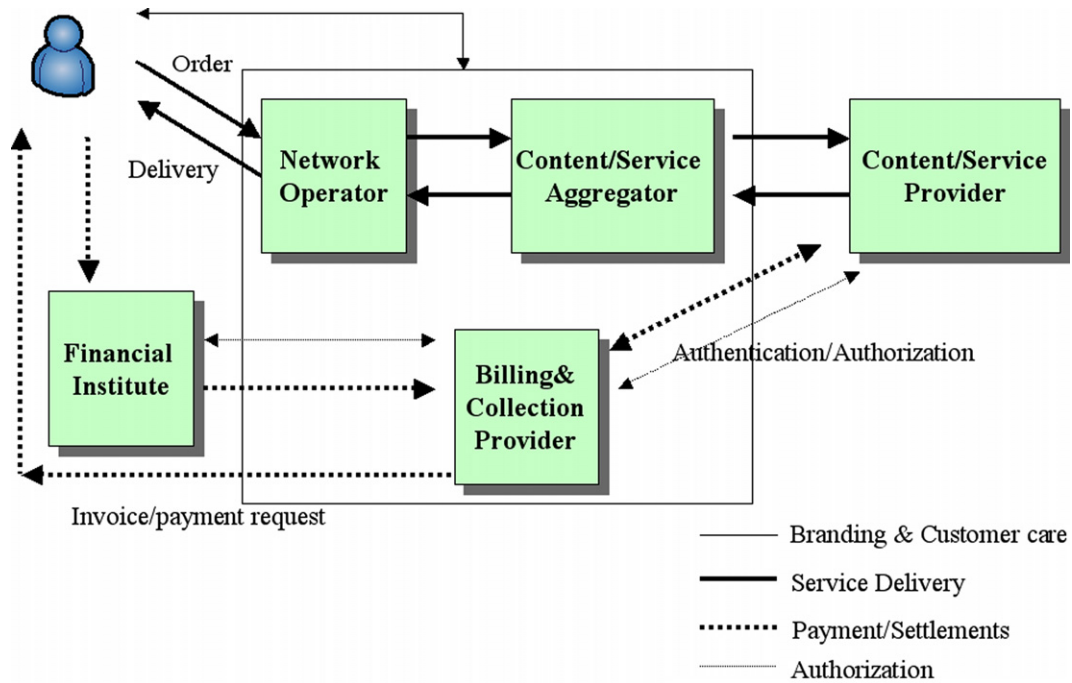


Fig. 1. Network operator centric business model.

place the network operator again in the central role of service provisioning [9,10]. However, cellular operators strive not to alienate their users and keep its predominance before such a perfect world comes true. In the past, little studies had ever clearly and deeply revealed for how to practically substantiate a lightweight system for connecting users, cellular operators and content/service providers by highly exploiting the mature cellular environment to achieve a triple-win situation.

In this article, a well-constructed A.A.A. brokering system sitting between CPs/SPs and users to link the value chain in such a triple-play game is presented. To simply realize this concept, we build a lightweight system, which generalizes certain basic mechanisms that govern authentication, authorization, advice-of-charge, accounting, billing, and settlement (thereafter referred to as “A⁴BS”). Through this system, content/service providers can focus on service creation without much attention to the end-user billing. Meanwhile, users can be charged on a transaction basis with an instant expenditure notification and conduct a one-stop payment in a single cellular bill as well.

The rest of this paper is organized as follows. Section 2 describes the architectural overview, the system components, and the functionality of each component in A⁴BS. Session 3 depicts a thorough transaction process flow. Session 4 presents the design and implementation of A⁴BS and covers some empirical experiments to analyze the system performance in term of the time consumption for some major processes as well as complete transaction time through different access channels from user viewpoint. Concluding remarks are finally drawn in Section 5.

2. A⁴BS system overview

The whole system architecture and some main modules in A⁴BS are shown in Fig. 2. The requesting users can buy the service/content via the HTML shopping pages through Internet or the WML ones through cellular networks by using their laptops or WAP-enabled phones. On the other hand, the partnership CPs/SPs are mainly responsible for producing interesting contents and services. A⁴BS is located between users and CPs/SPs. CPs/SPs communicates with A⁴BS through the predefined Simple Object Access Protocol (SOAP) [11] based interfaces. Prior to putting service items on the service menu portal (Service Menu Module), all services and their corresponding service rate/settlement plans must be registered and approved by CPs/SPs and the operator on A⁴BS by way of the administration interfaces (Admin Module). In addition, A⁴BS is periodically synchronized by the cellular billing system for the up-to-date user status. All users must be contracted and authenticated by the cellular operators. The whole system comprises several modules for different functions. Main functions in A⁴BS are illustrated as follows:

2.1. 1st A: Authentication

A⁴BS does authenticating users (Logging Module) for CPs/SPs. In general, the Mobile Subscriber ISDN Number (MSISDN) [12] is the login key to identify users in the cellular business. To defend users’ privacy from malicious use in the Internet, A⁴BS generates a one-time session ticket within a hidden MSISDN to carry out transactions at CP/SP sites. If users intend to purchase any content or

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