Business models for local mobile services enabled by convergent online charging

Frank C. Bormann, Stephan Flake, Jürgen Tacken

Abstract— **Local mobile services are personalized, context-aware services, which are offered by a "local" service provider via the infrastructure of a Mobile Network Operator (MNO). These service providers are typically small enterprises, focussing on certain user communities and their communication interests.**

For classical mobile telecom services like Voice and SMS, business models are currently operator-centric. For a new kind of blended, personalized, and context-aware services, business models have to be adopted considering additional actors.

Concerning the payment for using such services, convergent online charging and billing mechanisms seem to be well suited. We suggest a design based upon international standards and implemented as Web Services, such that they are fully applicable in SOA-based environments.

***Index Terms* — Mobile Service, Context Sensitivity, Business Model, Online Charging, IMS, Parlay X, Web Service, Service Creation, SOA**

I. Introduction

The work presented here is part of the ITEA project "Local Mobile Services" (LOMS). The LOMS project investigates methods and tools for development, deployment and use of context-aware mobile services. The main aim is to allow for easy creation of smarter services by non-expert service providers. Within the project, case studies of currently deployed local mobile services were investigated and market potentials in different segments have been analyzed [1].

It turns out that currently most business models for local mobile services are network operator-centric. They provide the access network and charging infrastructure and hold one key for value creation by offering different mobile services based on their pricing strategies. Only huge third party service and content providers have the opportunity to bring their services into the portfolio of the network operator.

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On the other hand, there are a lot of small- and medium-sized enterprises (SMEs) in different segments (e.g., health, tourism, publishing, maintenance), which can certainly benefit when they are enabled to offer their local mobile services via a mobile network infrastructure.

They can offer typical Internet services (Instant Messaging, chat, video download, local search, local news, etc.) enriched by context information of the users (e.g., presence, location). Additionally, the services (contents) can be personalized based on the user preferences.

In this paper, we first regard the business models of the different players, which deliver mobile services. As an example, a context-dependent payment flow is described between the main actors, clearly indicating the need for a flexible, convergent online charging mechanism. Afterwards, the necessary extensions of existing charging and billing mechanisms are described.

II. Business Models for Mobile Services

The following definition of the term "business model" is taken from R. Hawkins:

"A business model is a description of the commercial relationship between a business enterprise and the products and/or services it provides on the market. More specifically, it is a way structuring various cost and revenue streams such that business becomes viable, usually in the sense of being able to sustain itself on the basis of the income it generates."

A taxonomy of different business models for mobile services has been presented in studies on the mobile multimedia [2] and 3G markets [3].

Three basic business models according to the dominant players exist:

- Content provider (**CP**), which delivers digital content to the mobile user.
- Service provider (**SP**), which delivers mobile services to the mobile user.
- Network Operator (**NO**), which operates the access network infrastructure and delivers basic services to the user (e.g., Voice, SMS, Internet Access).

Currently some network operators already tend to take over the role of service providers or content providers to extend their business form being a pure "bit pipe" provider.

A. The LOMS Role Model

Within LOMS, two additional roles are considered to analyze business relations between the players in more detail (see Figure 1):

- The Platform Operator (**PO**), which operates a Service Delivery Platform including a Charging and Billing System (CBS).
- The Service Operator (**SO**), which provides a service creation tool including enabling services like charging and billing Web Services.

The PO provides enabling services like charging, billing, profile management of mobile users to the SO. On the other hand, he has contact to different NOs to reach a large base of mobile users.

The SO provides dedicated service templates for SPs operating in a certain segment (e.g., publishing, maintenance). Thus the SO is aggregating a lot of similar SMEs and supports them to easily create their services. The non-expert SP fills out predefined service templates and deploys them on the LOMS Platform. Both the templates and the deployed services can make use of external provider services that offer contents, context information, or other external services like news from a CP.

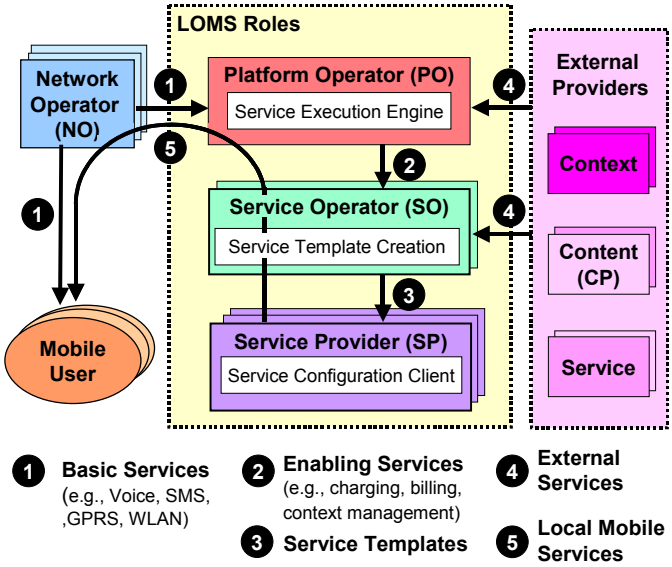

Figure 1: LOMS Role Model

To analyze the business between the LOMS players, it is important to see which LOMS role is responsible to define the pricing of the service usage and the models for revenue sharing. Three types of charges can be differentiated:

- Traffic charges for accessing the network.
- Service charges for using services.
- Content charges for downloading content.

A key challenge within the LOMS platform is to provide an open interface to existing Charging and Billing systems (CBS) and enable the SPs and SOs to define their usage tariffs and pricing. This has to be inline with the different value elements each partner adds to the service [4].

B. Mobile Services & Charge Types

Four main categories exist for mobile services today: Voice, Messaging, Internet, Content. We added a fifth category "Local Mobile Services" in order to consider context-sensitive services separately (see Table 1).

Mobile Services	Charge type	LOMS role
Voice Calls		
National, International	traffic	NO
Messaging		
SMS, MMS	traffic	NO
Mail, Instant Messaging, Chat, Blog	service	PO / SO
PoC, Video conferencing	service	PO / SO
Internet Access		
GPRS, UMTS (Cellular)	traffic	NO
WLAN	traffic	NO / PO
Content centric service		
Operator Portal (closed community)	service	PO / SO
Mobile portal (open community)	content	SP/ CP
Local Mobile Service (LOMS)		
Local Search (e.g., Point of Interest, ...)	service	SP
Local News (e.g., weather, traffic jam)	service	SP
FindAFriend	service	SP
Blended Service with context	service	SP

Table 1: Mobile services, charge types and LOMS role responsible to define pricing and revenue sharing

The switching of **voice** calls is the classical mobile service offered by a Mobile Network Operator (NO). Usually this is offered together with some **basic messaging** services like SMS/MMS. For these services, the NO defines the traffic charges for resource usage of his access network. Typically the user pays a few cents per minute or per SMS/MMS via a prepaid or postpaid account, which is managed by the operator's CBS.

There are **additional messaging** services like E-Mail, Instant Messaging, Chat, Blog, etc. which are services already known from the Internet, e.g., via a fixed telephone line (DSL). To make this kind of services available for mobile users, two conditions have to be met:

(1) The mobile user needs to have **Internet Access** with his mobile device.
(2) The additional messaging service has to be accessible by the user.

Typically there are two options for the first condition (1):

(a) The NO offers Internet Access based on GPRS or UMTS.
(b) The NO or PO offers Internet Access via WLAN.

Internet access is a basic service for the SO to build enabling services for the SP. For Internet access, typically traffic charges apply per volume (e.g., 10 ct/kb) or time (e.g., 10ct/min), which are defined by the NO or PO offering the Internet access.

To meet the second condition (2), the additional messaging service needs to be offered by a player. This could be the NO or PO. With regard to the LOMS role model, this is preferably the SO, because the additional messaging services are enabling services. The SO or respectively the SP has the option to define dedicated service charges per usage or a monthly subscription fee.

The same applies for more advanced messaging services like Push to talk over Cellular (PoC) or mobile Video

Conferencing. These services are typically implemented based on the Internet Protocol Multimedia Subsystem (IMS) [5]. Typically, *IMS-services* allow direct IP connectivity between mobile terminals and application servers using the Session Initiation Protocol (SIP) over any packet switched (PS) mobile network, supporting a multitude of different network access technologies. For LOMS, we assume that these IMS-services are offered either by the PO or SO and are blended with additional content and context sensitive services by the SP.

Content-centric services are defined by the kind and source of digital content offered to the mobile user.

Most mobile NOs have a portal (e.g., t-zone, Vodafone Live!, I-Mode) through which they provide access to digital content like ring-tones, images, news, TV-trailers etc. Typically the content is only available for mobile users, which have a subscription to access the portal (**closed community**). Some content is for free, included in the subscription, and other content is to be paid by a dedicated service charge (e.g., 1.00€/download). The NO will ensure the revenue sharing with the content provider. In case of LOMS, we assume that the NO can also adopt the role of the PO to define the service charges and conditions for revenue sharing.

Another kind of content-centric services are mobile portals, which focus on an **open user community**. These portals are offered by a CP (or SP), who aggregates content for his user community. For a mobile user, there is no dedicated service charge to access the portal, but content charges are applied per use directly by the CP or SP. This additional payment process is inconvenient, because the user needs an additional payment method (e.g, Credit card, PayPal, etc.) or has to rely on sending a Premium-SMS with fixed charges.

Generally, **local mobile services** can be blended services where a SP combines different services from the other classes to create a new service for the mobile user. In particular, messaging services or content can be adapted to the user's contextual situation (location, presence) or his preferences.

Typical examples for local mobile services are (1) a local search, which offers a list and more detailed information about Points of Interest (PoI) near by, or (2) a local news service that offers information on local weather conditions or traffic situations. Another service "FindAFriend" can locate other mobile users registered to this service and provides a route to meet them.

The SP is in this case responsible to define the usage tariffs and pricing for the service usage. The challenge is to correlate the different charges and revenue sharing between different partners when blending the services. For a local mobile service, everything can be dependent on the users' actual contexts.

III. CONTEXT-DEPENDENT PAYMENT FLOWS

In this section, we describe a typical scenario, which leads to a context-dependent payment flow. This flow has to be defined by the SP during service creation by filling in service templates provided by the SO.

The SP is a local newspaper publisher, which enriches the delivery of its print media with a mobile service providing regular video news on a mobile portal dedicated to a huge sport event. The SO is a news agency operating the mobile portal and establishing the connection to a CP, which is delivering video news of the sport event.

For simplicity, we assume that the PO has an arrangement with the main mobile NOs, so that mobile users can access the mobile portal and benefit from the context-aware service.

A. Mobile user outside sport arena

First we assume that the user is outside of the arena where the sport event takes place and accesses the Internet via GPRS with his mobile device. He will be fully charged for the network traffic (e.g., 0.50 €/Kb) when he browses the Internet. For access to the routing services of the SP, he has to pay 0.30 € per usage. The SO will do the settlement between the PO and the SP and retains 10% of each payment for that (see Fig. 2).

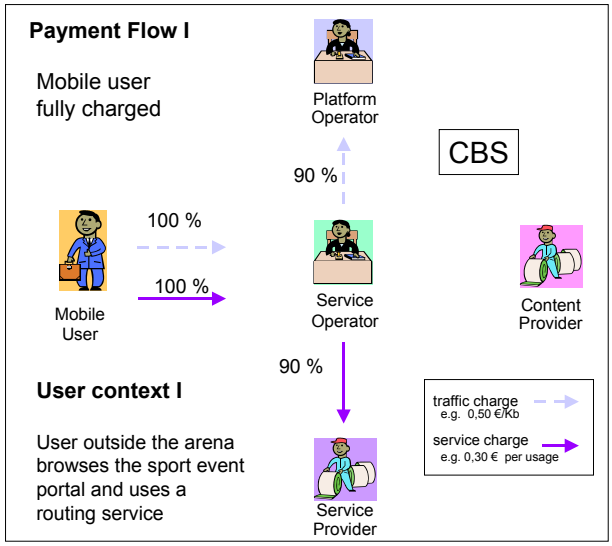

Figure 2: User outside sport arena fully charged

With the help of the routing service, the mobile user reaches the arena of the sport event.

B. Mobile user inside sport arena

Onsite he again accesses the Internet to use the local news service of the service provider. The context information of the user in this case will lead to a partial charging of his account. The SP will take over 50% of the traffic charges to boost usage of mobile services of users, which are in the event area.

Additionally, the SP provides discounts to the service charges for services offered via his sport event portal. For example, a local news query for latest results of the sport competitions is subsidized by 50%. Please note that discounts at this point cannot only be influenced by the context information of the user, but also by the service consumption history stored in the CBS.

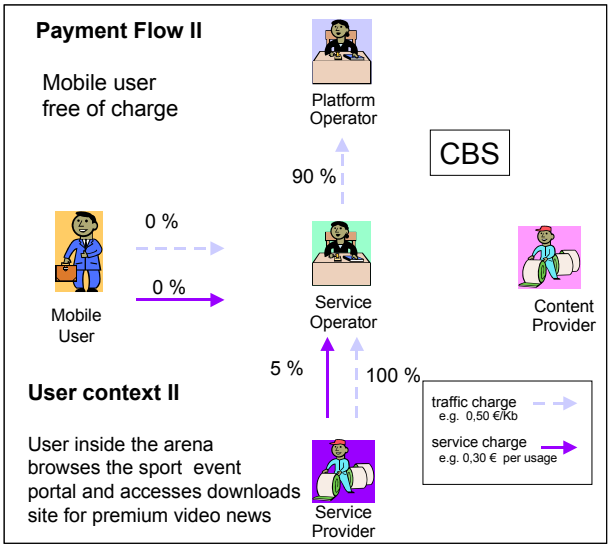

Figure 3: User inside sport arena free of charge

In another situation, the service usage may be even free of charge when accessing a site on the mobile portal where the mobile user can download content (e.g., video news of a recent sport competition) (see Figure 3).

In this case, the SP can resign to charge for the service and even take over the traffic charges for the mobile user. When the user later on decides to download a video, he can be partially charged for the traffic (see Figure 4). A motivation for the SP might be that he has some indirect revenue from sponsoring or branding activities going along with the content. As a consequence, the mobile user is willing to pay the resulting charge for the content and downloading it to his mobile device.

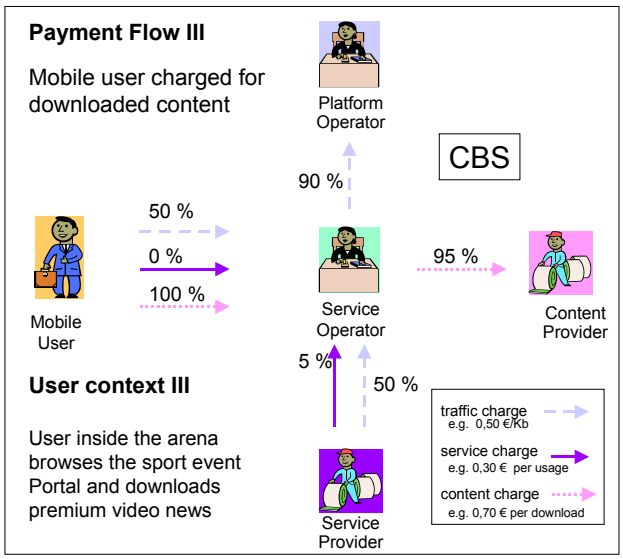

Figure 4: User inside sport arena partially charged for content download

It can be seen that the definition of pricing and revenue sharing, which is done by the SP and the SO, is the key to stimulate the service usage and to create a sustainable business for both actors. To implement such a content-dependent payment flow, a context-sensitive online charging mechanism needs to be implemented in the CBS.

Online charging is needed to allow credit control of a mobile user account. Furthermore, the user context can change during service execution (e.g., change in QoS), which may require a change in the charging mechanism.

For the mobile user, it is important to have transparence in pricing especially when the price can change according to his actual context. Thus, mechanisms like *Advice of Charge* prior to service usage or *Online Charging Indication* need to be implemented within the CBS [6]. The next section describes which technologies and standards should be considered when implementing such charging and billing mechanisms and briefly describes a suitable solution. A detailed description of the underlying Web Service infrastructure is given in [7]. Especially the deployment of Parlay Web Services can be seen as an enabler for different business models [8].

IV. Charging & Billing Mechanisms

In the charging architecture for mobile networks specified by the 3rd Generation Partnership Project (3GPP) [9], the so-called Charging and Billing System (CBS) is responsible for transaction handling, rating, online correlation and real-time management of subscriber accounts/balances.

There are several approaches for platforms supporting *offline charging* for future mobile services [10]. But it must be noted that the charging information generated for offline charging does not affect the rendered service in real-time.

By *convergent rating, charging and billing*, we understand corresponding operations

- for any type of service, such as voice, data, multi-media, and content,
- from any type of account, such as postpaid, pre-paid accounts, and
- for any type of charging model, i.e., subscription-based charging as well as event-, volume-, time- and reward-based charging.

Our approach is based on open standards, i.e., the Parlay X APIs for Payment [11] and the Diameter standard for credit control [12]. To enable reliable online charging and billing operations based on these open standards and usable by third party providers, we implemented a number of Web Services in front of Orga Systems' CBS called OPSC Gold[1]. Relevant for the above described business models are the Web Services for *Context-Aware Online Charging* and *Advice of Charge / Online Charging Indication*.

A. Context-aware online charging

This LOMS-specific Charging Web Service requires a CBS that supports online charging. It is built upon the volume-related payment operations proposed in the Parlay X Web Service Payment API and extends them by additional parameters `serviceID` and `contextInfo`. The latter parameter is basically a list of name/value pairs whose format has to be previously agreed upon between the SO and the PO.

[1] http://www.orga-systems.com/index.php?cat_id=3467

This Web Service supports charging of local mobile services – either directly (direct debit) or by means of subsequent charge reservations concluded by a final charge command. With the provided context information (`contextInfo`), the Web Service and the CBS can determine the involved players and how the actual costs for service usage (`serviceID`) will be shared between these players, like, e.g., the SPs, SOs, NOs, and Mobile Users.

B. Advice of Charge / Online Charging Indication

A second Web Service provides an Advice of Charge (AoC) before the actual service usage. This kind of AoC is able to rate the service usage *prior* to really using the service (AoC-P, see [6]). Currently offered AoC services only allow to obtain the usage costs either after a service has been set up (AoC-S), or during service usage (AoC-D), or even after service usage (AoC-E) [13].

The implemented AoC-P Web Service calculates service charges based on a provided volume expressed in, e.g., seconds or bytes, while also taking additional provided contextual information into consideration.

Additionally, a Web Service for *Online Charging Indication* allows users to set charging limits for services. This limit determines the maximum amount of money a mobile user is willing to pay for using a service. When service usage reaches the specified limit, the user will be notified by the specified kind of notification (e.g., a beep or a direct SMS).

V. Conclusion & Outlook

In future service oriented business architectures, value is generated on all service levels, i.e., content, service and network. Not everything can be paid via the traffic charges collected by a network operator, as additional charges from different actors apply. The key is to keep a transparent pricing to the user and ensure viable business models for all involved players.

Small Service Providers can have a high impact by generating network traffic and service & content consumption in several user communities. Service Operators can work as aggregators in particular segments (e.g., tourism, health, maintenance, publishing) to increase the multiplying effect on actively consuming mobile users.

We see convergent online charging and billing as a promising solution for reliable third party payment operations able to satisfy all involved parties. The corresponding enabling services suggested in this article allow context-aware Advice of Charge and charging operations. Summarized, the features are:

- Context-aware online and offline charging for service usage, allowing the SPs, SOs and POs to define the pricing and revenue sharing.
- Provide Advice of Charge *before* an actual service usage to mobile users.
- Setting a charging limit to allow a mobile user to define a maximum amount he is willing to pay for a dedicated service usage.

For the future, it is expected that mobile consumers will become mobile "prosumers" actively creating content or services. Thus everybody can become a SP or CP, which will further challenge the business modelling and charging mechanisms to be developed.

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