Mobile Internet charging: prepaid vs. postpaid

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Abstract

This engineering note is about prepaid charging and comparing prepaid charging with post paid charging. I also try to find out what kind of challenges mobile Internet will bring in prepaid world.

1   Introduction

The number of prepaid customers has rapidly grown in recent years. Prepaid customers have grown to be the largest customer group in Western Europe. Various techniques for implementing prepaid charging will be explained in the following sections. Additional challenges of mobile internet are also discussed in this engineering note.

2   Prepaid in general

2.1   Prepaid in Western Europe

Prepaid customers have traditionally been viewed as a secondary customer group, postpaid customers being the primary. They have been seen as low income, non-credit worthy customers that produce low average revenue per user (ARPU). The issues about credit worthiness and low income cannot be easily verified because of the lack of availible customer information, but this is not very important because what really matters is the ARPU. This has been and still is significantly lower among prepaid customers than postpaid customers. Nevertheless, prepaid subscribers should be recognized as very important customers just because of the size of the group. In addition prepaid customer group includes one very important customer segment, which is teenagers and other young people. Although this group is not very credit worthy it is fast in adopting new services.

Because operators have viewed prepaid customers as less desirable than postpaid, prepaid markets have remained untapped until the saturation point of postpaid customers has been seen in the near future. Figure 1 illustrates this development.
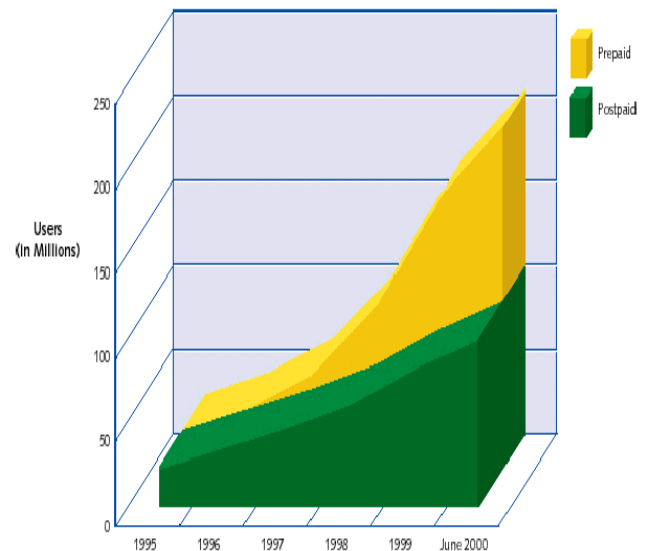

Figure 1:Growth of mobile phone users from 1995 to 2000, (source: Yankee Group)

In Western Europe the rapid growth of prepaid customers started approximately around year 1998 [3]. Today over 60% of Western European mobile subscribers are using prepaid charging. The secondary customer group has become the largest customer group. Even though prepaid is the largest customer group it is responsible for only one third of the total revenue.

The penetration rate of mobile subscribers was in 1998 37% in Western Europe and in 2001 it was 76%. Introduction of prepaid services has been the main driver in the rapid growth of penetration rates in Western Europe [1][3]. Table 1 illustrates the relation postpaid and prepaid minutes of usage with few European operators and OECD countries on average.

Table 1: Relation between postpaid and prepaid users in OECD countries

Operator	Country	Prepaid cards share of total subscribers (%)	Postpaid MOU	Prepaid MOU
Optimus	Portugal	81	360	80
Libertel	Netherlands	66	183	61
Panafon	Greece	62	137	51
OECD		43	198	64

Table 1 holds only so few examples, that it is very hard to make any good conclusions but it can be clearly seen that prepaid users indeed low usage users compared to postpaid users.

Prepaid and postpaid tariffs differ significantly. Postpaid tariff plans are usually very complex with many changing factors such as monthly charge, charge per minute depending on time of day, rental of mobile device etc. Prepaid tariffs are usually a bit simpler. Often prepaid tariff consist only the charge per minute. Of course these tariffs are extremely operator dependent but on a general level I would say that prepaid tariff plan are simpler that postpaid. Prepaid calling time is usually more expensive than postpaid but prepaid is free of monthly charge.

Western Europe clearly has the largest number of prepaid users (see figure 2). In most other places prepaid is just starting to emerge. For example in US the growth of postpaid users is starting to slow down. Operators have great pressures in getting new subscribers. According to reference [2] operators have started fierce price competition. This leads to decreasing of the revenues of old customers. Reference [2] suggests that this kind of development could be avoided by introducing more prepaid services. This would separate the two customer groups and disable them from affecting each other's revenue.
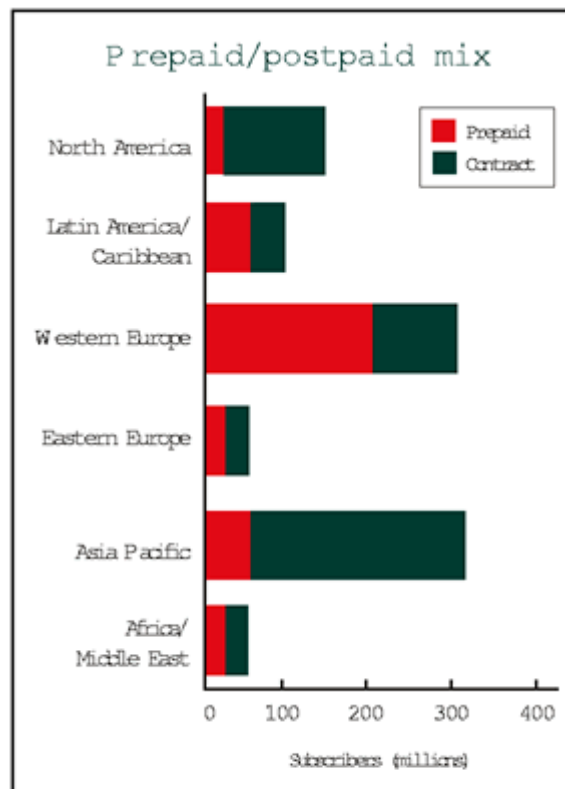
Source: The Strategis Group

Figure 2: Prepaid in different parts of the world

2.2 Advantages and disadvantages of prepaid

Prepaid has many advantages compared to postpaid. Following list explains few of them.

- Operator gets the money before the call is made and it can invest it or at least earn interest on it.
- Operator saves in billing expenses
- There is no credit risk
- Some customers prefer to operate only on cash basis. Without prepaid this customer segment would be unreachable for operators.
- In some cultures cash transactions are preferred over credit transactions
- Some customers will never use their whole balance
- Customers who want to enjoy anonymity can also use mobile phones

Major disadvantages of prepaid charging:

- It is difficult to get information about customers

- Customer loyalty is hard to maintain. Churn is higher with prepaid customers
- Criminals prefer prepaid because of the anonymity
- Real time charging systems are needed
- Operator needs a separate top up system

2.3 Prepaid in GSM networks

The emergence of prepaid in GSM networks can be seen as normal evolutionary market development. First operators wanted to satisfy the needs of the most profitable market segment and after the growth in that segment begins to decrease the operators want to move to other segments.

There are four alternative solutions for implementing prepaid service in GSM network. These are:

- Intelligent network (IN)
- Service node
- Hot billing
- Handset based approach

Illustration of technologies lies heavily on [4].

Prepaid in IN

Figure 3 illustrates how intelligent network based prepaid solution is implemented in GSM networks. This and all the other illustrations about technical implementations are presented consciously in a quite rough level because the true complexity of these technologies lies beyond the scope of this presentation.
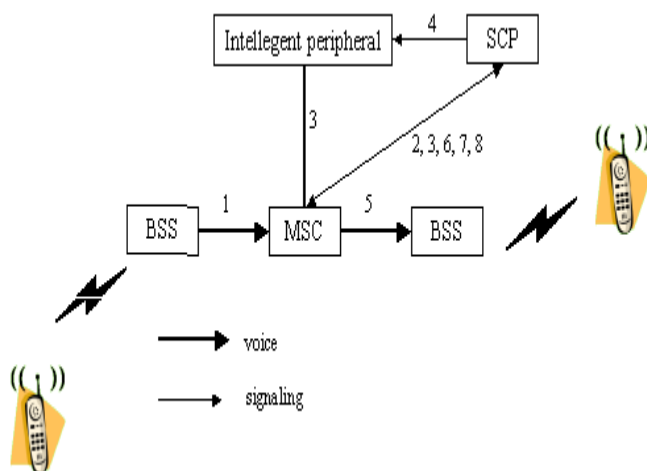

Figure 3: Prepaid in IN

1. Customer initiates a call

2. Mobile switching center (MSC) gets IN call setup trigger. It suspends the call and sends a message to service control point (SCP) that handles the prepaid account.
3. SCP instructs MSC to set up a voice link to intelligent peripheral. This link is used for notifications about the status of prepaid account.
4. SCP gives instructions to intelligent peripheral about account notifications.
5. SCP starts countdown timer and instructs MSC to connect the call
6. Call terminates because countdown timer has expired or the call is completed or…
7. MSC gets IN call release trigger, sends disconnect message to SCP
8. SCP computes the cost of the call, charges the prepaid account and sends current balance and cost of the call to MSC.

Prepaid by using service node technique

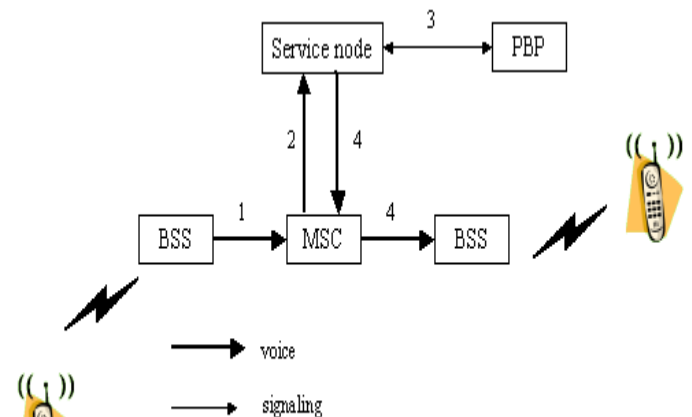Figure 3 illustrates the implementation of service node prepaid technique in GSM networks.

**Figure 4: Service node prepaid**

1. Customer initiates a call
2. MSC detects that the caller uses prepaid account and sets up a voice channel to service node
3. Service node asks from the prepaid billing platform (PBP) if the call should be allowed
4. If call is allowed, a second voice channel is established from service node trough MSC to the called party

This method costs one extra voice channel compared to IN prepaid. On the other hand it is easy to implement

because MSC does not need to know about prepaid service. The only thing it needs to know is to connect all prepaid customers to service node.

Prepaid using hot billing

Figure 4 illustrates the hot billing implementation of prepaid in GSM networks.
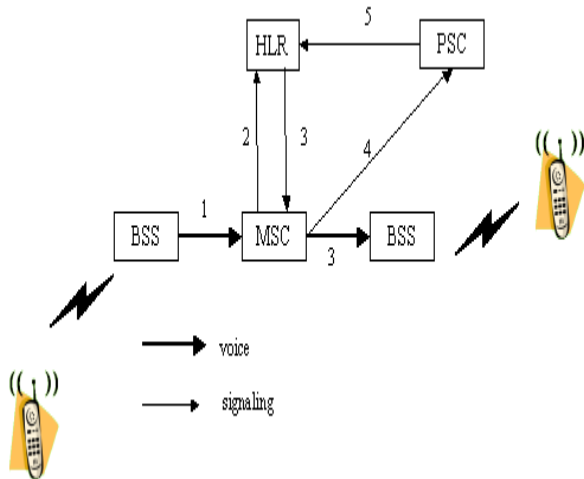
Figure 5: Prepaid using hot billing

1. Customer initiates a call and sends its international mobile subscriber identity (IMSI).
2. MSC asks from HLR if the service request is valid. Using IMSI HLR checks from authentication center the validity of the call.
3. HLR sends customer data to MSC and MSC connects the call
4. When the call terminates call detail records are sent to prepaid service center (PSC)
5. PSC charges the account. If the account is empty PSC notifies it to HLR and service is suspended.

In this technique the billing is not real time and the operator is exposed to credit risk of one call.

Handset based prepaid

Figure 5 illustrates the handset-based implementation of prepaid.
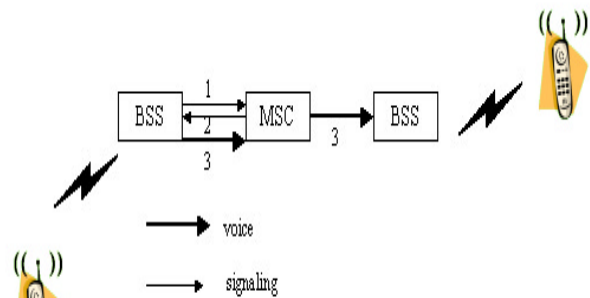
1. Customer initiates the call
2. MSC sends the pricing parameters to mobile station. Mobile station uses these parameters for decrementing the account
3. MS acknowledges the parameters and the call is connected
4. During the call MS decrements the prepaid account which is stored locally in the SIM card.

Top up systems

Top up systems are used to update the prepaid balance. Traditional ways of top up are vouchers and rechargeable phone card. The problem with these methods is that user has to go to some store in order to buy more talking time. One more resent way to update the balance is by using cash machines [5], but this really does not solve the problem of physically going somewhere to update the balance. A more customer friendly and quite resent solution is to allow the customer to allocate one of her debit/credit cards for updating the balance [5]. This ways the customer just calls to operators call center whenever she wants to update the balance.

3   Prepaid in mobile Internet

3.1   Prepaid in GPRS networks

Mobile Internet in Europe currently and in the near future means Internet services provided via GPRS networks. Operators in some European countries are experiencing great pressures in implementing prepaid GPRS services. Huge popularity of prepaid services in some European countries makes the evolutionary type of development of prepaid, that was experienced with GSM, impossible. For example in Italy over 90% of mobile subscribers are using prepaid [7]. In many places implementing prepaid to GPRS networks is the only way to get to mass market. At least Telecom Italia Mobile has already implemented prepaid in GPRS. Technical problems are more or less similar to problems that where

experienced when prepaid was implemented in GSM networks. Solving these problems requires acquisition of equipment that can handle real time billing and top upping of the prepaid account. Implementation of prepaid to GPRS has only started very recently and the ways of doing it are still developing. I found two ways of doing it properly: intelligent networks approach and server approach. Figure 6 illustrates the server-based approach.
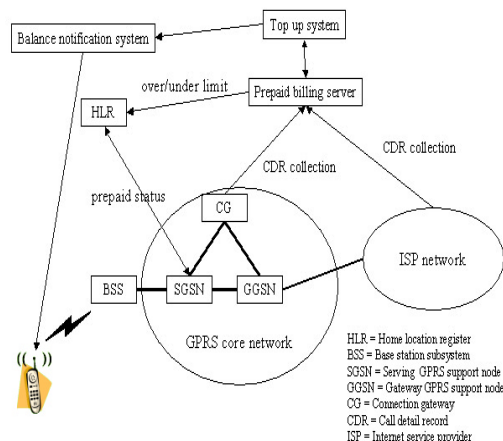
Figure 6: Server based prepaid

The connecting procedure is pretty much the same as the procedures in previous sections. The main difference in GPRS prepaid is that call detail records are gathered from both GPRS core network and ISP network. This adds to the complexity of GPRS prepaid system.

3.2 Challenges in prepaid

The biggest future challenge in prepaid will be increasing ARPU and decreasing churn. Because prepaid customers are and most likely will also in the future be a low usage customer group, this will always be a challenge for prepaid. However, mobile Internet brings some effective tools for this purpose. Operators can offer value added services in the Internet. With these services operators can differentiate themselves from their competitors and at the same time gather information about the customers by requiring registration to the services. Now that they have access to customer information, it is much easier to develop customer care and customer loyalty programs. Personalization of services should be encouraged, because if customers have spent time in personalizing their services, they are not so keen to change to another operator's services.

Avoiding price competition will be another challenge. Prepaid users appreciate low prices and operator probably could win competitors' customers by offering lower prices. Nevertheless this should be avoided because prepaid customers are already producing low ARPU and aggressive price competition could really hurt the profitability of this customer group.

Deployment of prepaid systems in GPRS has to be much faster than it was in GSM. In GSM introduction of prepaid systems was evolutionary development and operators had plenty of time to improve their network resources. Now that prepaid GPRS is introduced there already exist a large prepaid customer population who want to use GPRS services right away.

Roaming will be a challenge. Necessary facilities for prepaid GPRS roaming are already defined in CAMEL phase 3 [6]. However it will take several years before CAMEL phase 3 is implemented in the majority of European operators networks.

GPRS has to somehow enable charging of non-discreet events, such as file download. It might happen that user runs out of balance in the middle of file download. If operator just cuts the connection when the account is empty the user ends up spending money for nothing.

Top up systems need to be improved, so that it is as easy as possible for customer to update her balance. m-commerce might bring a solution to this problem. It would be handy if customer could update her balance directly from the mobile device with out going to the store first. Debit/credit card systems are a good step to the right direction.

Some suggest that one challenge would be turning prepaid customers into postpaid customers. I am not completely convinced that this is a good solution because operators would have to offer the same advantages in postpaid as they are now offering in prepaid and this could lead to previously mentioned price competition and decreasing revenues in postpaid sector. If some customers would be persuaded in becoming postpaid customers I would very much doubt that the ARPU of these customers would increase because of the change in charging methods.

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