

Total cost of charging and billing: CapEx and OpEx

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Abstract

The purpose of this paper is to give an overview of charging and billing system costs in the area of telecommunications business. First, the structure of the billing and charging system is briefly explained. Estimates for capital (CAPEX) and operational (OPEX) expenditures will be presented as well as how billing requirements in wireless IP-based networks will affect these.

1 Introduction

Charging and billing is a crucial part of telecom service providers operation to recover financial investments in the infrastructure and generating profits for shareholders [2]. Charging is the process where subscriber accounting information is retrieved for billing purposes, i.e. to write a bill according to a specific tariff and criteria.

2 Service provider's CAPEX and OPEX

Capital expenditures include investments in network infrastructure, charging and billing systems etc.

Operational expenditures include costs on labour for network management and charging/billing system and customer relationship management, software support/upgrades, marketing costs etc.

Operational costs are almost always higher than investments. Even for UMTS annual CAPEX is typically much less than OPEX[1].

For new players in wireless segment, marketing costs are a major part of OPEX and investments on network infrastructure are a major part of CAPEX.

3 Charging and billing systems

Charging and billing systems are complex and they can be seen as an integral part of larger subscriber management systems [4], referred to as Operational Support Systems (OSS) and Business Support Systems (BSS). This integration is expensive but necessary in order to automate charging/billing process, service provisioning and customer relationship management.

Network infrastructure vendors typically offer technology-dependent solutions that deliver extensive out-of-the-box functionality for their own products but additional software is required in order to integrate these to service providers internal processes.

3.1 Structure of charging and billing system

Figure 1 illustrates the structure of billing and charging systems. Billing system is far more complex than charging. Charging system consists of two layers: network infrastructure and mediation. In circuit-switched networks charging information is generated by network elements (MSCs, PSTN switches) based on subscriber id. Mediation devices are typically used to de-couple network and billing system. These devices manage subscriber databases and collect charging information from different sources. In addition, they hide the vendor-proprietary or device-specific information by providing charging information (CDRs) for billing systems in a common format.

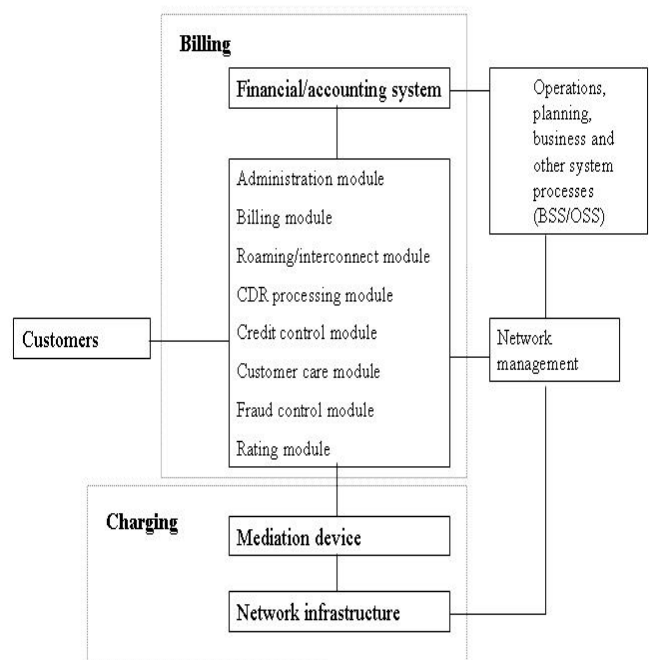


Figure 1. Charging and billing system processes [2][5].

Billing system includes at least following subsystems:

- *Customer care* administration module handles customer, contract and subscription information and enables the service provider to tailor contracts for individual subscribers/customers.
- *Credit control* module allows the service provider to monitor subscriber's credit level and calls and take action against a particular subscriber if needed.
- *Rating* module is responsible for the process of calculating how much a subscriber should pay for an individual call/transaction. The tariff is the set of business rules that are applied to subscriber's calls/transactions. Call rating can be manually or automatically initiated. Automatic initiation ensures that there is a minimum delay between the times a call is made to the time a rated call is available for credit control, fraud control and pre-payment management [5].
- *Roaming/interconnect* module supports individual billing agreements with roaming partners and interconnected networks.
- *Billing* module configures and maintains the billing and invoicing process.
- *Administration* module provides service provider with the tools to manage the complete billing system.
- *CDR* processing module retrieves the data records from mediation and network devices for billing purposes. A misconfigured mediation device or network element could cost the operator millions of euros in the form of lost CDRs.
- *Fraud control* module for detecting frauds. Fraud detection still requires a lot of manual effort and is a challenging task for pre-paid services.

In addition to these (or part of billing module, if one prefers) the subscriber bills need to be printed and posted.

Different customers segments and services require tailored billing solutions. These customer-tailored services, m-commerce and future charging options require that the interfaces to the billing system are flexible and the billing system itself easy to expand.

3.2 Company internal and external billing processes

Telecommunication regulation has driven telecom operators to split their organisations into two: network

and service operators. This has somewhat increased the operational costs since there is more people involved..

4 Total costs of billing and charging

The total cost of providing and maintaining billing system may be up to 50% of infrastructure investment and annual turnover of a mobile network [3]. Naturally this depends on the services being provided. An ISP providing internet access with a fixed monthly subscriber fee does not require a complex billing system whereas a telco providing a wide selection of PSTN/GSM/GPRS/3G/WLAN and other internet services will most definitely needs one .

It is difficult to give exact figures since the costs depend on several factors, like the number of subscribers/customers, network infrastructure (circuit vs packet switched, fixed wireline vs mobile), services being offered, business processes, billing integration to OSS/BSS etc.

A rough estimate can be calculated for a mid-size telco based on some well-known average values. These figures are represented in table 1 and explained below.

4.1 Billing related OPEX

Most operational costs are related to personnel (100), and processing costs. Personnel or labour costs consists of running the billing systems, tailoring billing systems for special customer purposes, contacting customers, cross-checking the CDRs and fraud management. Post-processing the bills consists of printing and posting the bills to subscribers. Billing related OPEX is a significant part of the total costs.

4.2 Charging and billing related CAPEX

According to mediation software company Comptel the billing system costs (hardware and software) can be anything between 10-50Meur. Here it is assumed that the average price for a billing system is 20Meur and payback period is five years. Software support and upgrades are estimated to be 10% of purchase price. According to Comptel, the price of a mediation software/hardware is one fifth (1/5) of the price of a billing system, so an average of 5Meur for the charging system is used.

4.3 Charging related OPEX

Operational costs for charging consists mainly from maintenance and installation tasks. This figure would probably be larger in case the telco is providing packet-based charging.

Table 1. Total cost estimate.

OpEx, billing	unit price	#	Total
Personnel	90000	x100	9000000
Post-processing	6000000	x0,5	3000000
prepaid/inter-operator		?	
marketing	200000	x1	200000
			12200000
CapEx, billing			
Billing system	20000000	/5	4000000
Software upgrades	20000000	x0,1	2000000
CapEx charging			
Charging system	4000000	/5	800000
Software upgrades	4000000	x0,1	400000
OpEx, charging			
installation and maintenance	90000	x10	900000
			900000
CapEx			7200000
OpEx			13100000
Total			20300000
CapEx % of total costs			35%

4.4 Total costs

According to the calculations in table 1, CAPEX would be around 35% of total costs (billing+charging). If the payback period had been longer the percentage had been even bigger. According to Norbert Scholz from Gartner Group, for a mid-size telco (3-7 million subscribers), billing software licenses are around 7Meur. Hardware and 3rd party software add another 4Meur and integration cost can be up to 200-500 percent of license costs. For maintenance and support, there will be 2Meur expenses annually, and for operating costs somewhere around 4Meur. For a payback period of five years, this would mean that annual CAPEX is around 8Meur and OPEX 4Meur. Still, these figures probably don't include company internal billing, processing of subscriber bills or maintaining customer contacts.

There are several ways of expressing the individual and total costs related to billing and charging.. If measured by the costs of generating, printing and sending a bill to a subscriber, the price can be several euros per bill.

From the individual billing processes, generating/printing and sending the bill is typically the most expensive. The costs depend heavily on the number of subscribers and how often the bill is generated and

posted. Also the billing system license costs depend on the amount of subscribers. Fraud control/management is also an expensive process, since it requires a lot of manual effort.

5 Billing models and new requirements for charging and billing in IP-based networks

Internet is the dominant network infrastructure and also wireless networks are evolving towards 'all-IP' architecture. With this evolution comes also the requirement of charging and billing for wireless access, content and services.

Packet-based network introduces new challenges concerning billing and charging:

- Billing and charging for Internet applications, services and content used by subscribers.
- Enabling prepaid services: Fraud-window elimination for prepaid services introduces complexity to network devices.

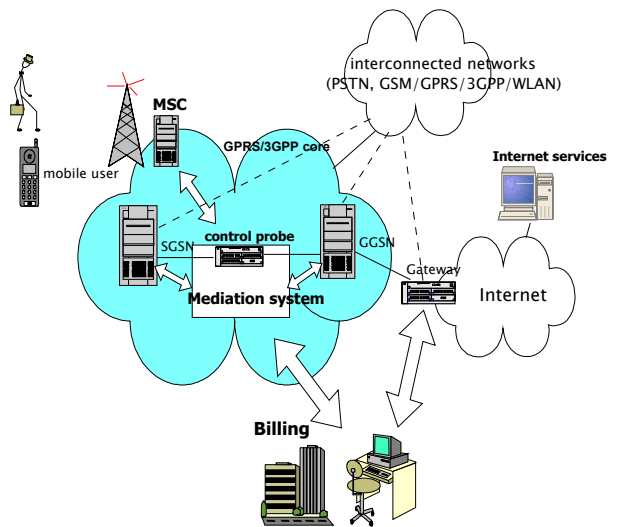


Figure 2. Packet-based billing and charging challenges.

Considering different billing models, flat fee is the least expensive option. This fixed price charging doesn't require mediation or complex charging info (CDRs, packet counts) from network elements.

According to Nokia [7], the optimal tariffing strategy for GPRS would be a combined monthly fee and volume-based tariffing. For always-on IP network connections volume typically means amount of transferred bytes. Volume-based billing is a way to control the network

resources when network resources are scarce (like in radio networks). Volume-based billing requires that network elements (or mediation devices) can provide accurate traffic statistics. This increases total billing and charging costs.

5.1 Billing and charging for messaging, Internet services and content

In order to be able to provide billing and charging based on messaging, internet services and content, a deeper knowledge of subscribers traffic patterns is required. This could be implemented in a form of on-line mediation and traffic monitoring using special control probes (network infrastructure) inside the packet core of 2,5G/3G networks. These control nodes could count SMS, MMS or e-mail messages or identify applications and services used by subscribers and generate charging information. Nevertheless, these solutions increase both investment and operational costs for billing and charging.

5.2 Fraud detection for prepaid services

Fraud detection is required by default in present billing and charging systems. Even for circuit-based networks fraud detection and window closing is a challenging task. Prepaid services are very popular in Western (63% of subscribers) and Eastern Europe (55%) [6]. The goal is to have convergent billing model, i.e. to provide same services to both prepaid and postpaid subscribers. For prepaid packet-based services fraud detection should be performed in real-time, Again, on-line mediation and special control probes can be used like for services and content billing but has an additional impact on CAPEX and OPEX.

5.3 Roaming

Roaming requirements are also more complicated. Future networks are heterogenous networks consisting of many different network technologies, where the user is not just roaming between different operators but also between networks of different technologies. This complicates billing systems by introducing more interfaces to external systems and networks.

5.4 M-commerce

Due to the charging and billing costs, many telcos form a separate company offering billing services to other telcos and service providers. Same billing platform is extended to handle different electronic payments (micropayments for parking and tram tickets etc using mobile phone, event-based billing.) for both wireless and wireline applications. These payments are then added to the

subscribers phone bill and the billing company acts as a broker in the service delivery and billing process.

6 Conclusions

Charging and billing is a critical part of telecom service providers operation to recover financial investments in the infrastructure and generating profits for shareholders. A failure or inaccuracy in collecting charging information from network can cause provider to loose significant amount of money.

Today charging and billing are an integral part of company's BSS/OSS and as such, the costs related only to charging and billing are difficult to estimate. The total costs depend on many different factors, for example what are the services being offered and how many subscribers there are.

The least expensive billing/charging method is fixed price tariffing. This is a typical ISP pricing scheme. Mobile operators need to invest considerably more in order to implement volume and time-based billing. For mobile operator, the total cost of providing and maintaining billing system may be up to 50% of infrastructure investment and annual turnover of the network [3]. From the total costs OPEX is the major part. New on-line real-time mediation systems are required to support billing and charging (including prepaid) for internet services, messaging and content. This complicates both mediation systems and billing processes.

In order to minimise costs, smaller telcos are outsourcing their billing systems and services. Those telcos which invest and operate their own billing systems try to cover the costs by extending the systems to support billing for different m-commerce applications and selling billing services.

7 List of vendors

7.1 Billing system vendors

ADC, Alltel Information Services, Amdocs, Aptis, Aris Software, IBM, Lucent Technologies, Proxima Systems, MaxBill, Telution, UDP, Verizon Data Services etc.

7.2 Billing mediation vendors

Ericsson, Comptel, Xacct, Narus, Portal etc.

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